STUDENT INDEPENDENT PROJECTS

ENVIRONMENTAL STUDIES

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GRENFELL CAMPUS | MEMORIAL UNIVERSITY

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I am delighted to have this opportunity to introduce the 2014 collection of Environmental Studies Independent Research Projects. Environmental Studies 4950 is quintessentially a fourth-year course for senior students who independently complete a research project with the helpful guidance of their supervisors. In this process, each student has the opportunity to research an environmental issue of their choice by applying the knowledge and methodological skills they have acquired during their undergraduate experience.

The Environmental Studies Program at Grenfell Campus is an interdisciplinary program focused on the environment. It strives to demonstrate through its teaching and research endeavours that it embraces numerous disciplines and brings knowledge from these various areas together into a broad synthesis of understanding. The papers in each year's collection of student projects are good examples of our program's diversity and the keen interest our students have in examining environmental problems from different perspectives. The students choose topics that they want to examine, complete literature reviews, identify topical relationships and contradictions in the literature and, in many cases, conduct original research in the form of surveys and/or interviews followed by quantitative data analyses.

This year's collection of Environmental Studies student independent projects includes six research papers:

- ***A SWOT Analysis of the Canadian Boreal Forest Agreement and Natural Disturbances in the Boreal Forest and Protected Areas,*** by Mr. Brandon Curry.
- ***Social Impacts of Large-Scale Natural Resource Development in Canada's Northern Indigenous Communities,*** by Miss Shena Fowler.
- ***Green Revolving Funds and the Path to Sustainability for Grenfell Campus, Memorial University of Newfoundland***, by Mr. Glen Keeling.
- ***Popular Media Discourse Surrounding Issues of Labeling and the Human and Environmental Health Impacts of Genetically Modified and Non-Organic Food,*** by Miss Kelly Keresteci.
- ***Wind Energy Policy in Newfoundland and Labrador: Harnessing North America's Greatest Energy Resource. A SWOT Analysis and Policy Recommendations***, by Mr. Nicholas M. J. Mercer.

These research papers deal with timely and important environmental topics which are relevant either for our Province, or for Canada, or for the world in general. The research papers are scientifically sound and our students' treatment of their topics is original and refreshing. We hope that their conclusions will be useful for informing the decision-making processes concerning various environmental issues which need attention now or in the future.

Congratulations to our students for their diligent work and good accomplishment! Special thanks to Professors Stephen Decker and Ivan Savic who supervised most of the students' work on these projects. Thanks are also due to all Environmental Studies faculty which assisted in one way or another with the successful completion of our students' program degree. This faculty include: Lab Instructor Richard Butt, Professor Stephen Decker, Dr. Paul Foley, Dr. Morteza Haghiri, Dr. Andreas Klinke, Dr. Michael Newton, Dr. Nick Novakowski, Professor Ivan Savic, Professor Randy Skinner, Dr. Michael Van Zyll de Jong, Dr. Jianghua Wu, and Dr. Gabriela Sabau.

On behalf of the Environmental Studies faculty, I wish our graduates continued success in their future careers.

Gabriela Sabau, Chair
Environmental Studies Program

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SWOT Analysis of the Canadian Boreal Forest Agreement: And Natural Disturbances in the Boreal Forest and Protected Areas

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The Canadian boreal forest agreement (CBFA) is a relatively new agreement between environmental non-governmental organizations (ENGOs) and industry companies. There are a number of well known industry and environmental groups involved in the agreement, such as Kruger and the Canadian Parks & Wilderness Society (CPAWS). This paper discusses the CBFA and its strengths, weaknesses, opportunities and threats (SWOT analysis). There is also a discussion of natural disturbances in the boreal forest and protected areas.

Introduction

Sustainable resource management has been a difficult thing to maintain, due to the complexity of all the intermingling systems involved. These systems in themselves are complicated and contain various inter-related parts which require thinking in terms of connectedness, relationships, context and aggregation instead of disaggregation (Ewert & Baker, 2004). In addition to the inter-related natural systems there are also human systems that need to be considered when dealing with resource management. These human systems include communities, economies, cultures and political systems which are also interacting with each other as well as with many environmental systems (Ewert et al., 2004). Natural resource management traditionally used input/output models, in which humans were viewed as users but not as a part of the environment (Ewert et al., 2004). Resource management has numerous desired outputs such as long term sustainability, conservation of species, biodiversity, environmental and human health, and fewer conflicts over the resource use, and maintaining the quality of life for residents in the area. There is a need for resource management to be conducted in a way that all the challenges are being dealt with, while continuing to collaborate with all parties involved while not ruling out any environmental issue that could arise along the way.

Integrated approaches to resource and environmental management have been adopted and employed in several resource and environmental management contexts and different scales in the field of environmental resource management (Born & Sonzogni, 1995). Although there is no broadly accepted definition of integrated resource and environmental management (IREM), Slocombe & Hanna (2007) state that,

> in an ideal sense, IREM draws on scientific and other forms of knowledge, information and other forms of technology, and collaborative and other processes to foster better resource and environmental management through improved integration of some or all of, but not limited to, the following dimensions: discipline, information, spatial/ecological units, governments, agencies, interests/sectors, and perceptions, attitudes and values. (p.13)

Integrated resource and environmental management has been used in some of the most complex, vulnerable and threatened ecosystems in North America including “The Everglades, the Great Lakes, Chesapeake Bay, the Flathead Basin, [and] the Greater Yellowstone region”

(Born & Sonzogni, 1995, p. 167). Integrated resource and environmental management brings together all the different values and uses of an area in order to come to a solution for the complex and ever growing environmental issue at hand, this would include government groups, non-government groups, concerned citizens, recreational groups, and many more.

A recent and important conservation effort which appears to embody many of the characteristics of integrated resource and environmental management (IREM) is The Canadian Boreal Forest Agreement (CBFA).

> Canada's boreal forest is one of the largest and most ecologically significant ecosystems on the planet and the source of supply for one of Canada's most significant natural resource sectors. Recognizing this, forest companies and environmental organizations in Canada came together to create the Canadian Boreal Forest Agreement. This global precedent integrates economic and environmental values to ensure a sustainable future for our boreal forest, our natural habitat, our forestry industry and all those whose livelihoods rely upon it. (CBFA, 2013, 1)

The CBFA is a collaboration between twenty-one major forest product companies and nine leading environmental groups (CBFA, 2013). This unique collaboration between environmental groups and forest product companies has resulted more than 26 million hectares of forest being protected all across the country (CBFA, 2013). The Canadian Boreal Forest Agreement has six individual goals, which are to:

1. Implement world-leading sustainable forest management practices.
2. Accelerate the completion of the protected spaces network for the boreal forest.
3. Fast-track plans to protect boreal forest species at risk, particularly woodland caribou.
4. Take action on climate change as it relates to forest conservation.
5. Improve the prosperity of the Canadian forest sector and communities that rely on it.
6. Promote and publicize the environmental performance of the participating companies.

(CBFA, 2013)

While the Canadian boreal forest agreement holds great promise for the integration of various relevant interests with the ultimate goal of achieving significant nature conservation gains, there are several possible concerns which warrant consideration. For instance, as only industry and environmental non-governmental organizations (ENGO) interests are represented it is conceivable that one set of interests could overpower the other. Though both sides seem up to the challenge now, what will happen in the future if, for example, industry decides that the protected land is of high value for commercial logging? Another issue worthy of consideration is that without input from provincial or federal protected areas agencies, will the CBFA created protected areas be effective? As smaller, fragmented forest areas are susceptible to natural disturbances. It is important to note, that despite these (and other) potential drawbacks that there are also a number of potential positive impacts which should be highlighted and explored further. For instance, if both parties continue to work together and co-operate, substantial areas of boreal forest, otherwise slated for harvesting, could be set aside to protect biodiversity and associated habitats for generations to come. This paper will examine both these potential strengths and weaknesses by using a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis. The findings of the analysis could have implications on all the areas under the CBFA across the country and can help guide similar collaborative agreements in the future.

Methods

Qualitative and Quantitative Approaches

Qualitative approaches include human centered techniques (Palys, 2003) which allow researchers to explore unlimited variables through more direct interactions with study participants. Qualitative approaches also allow the researcher to explain and explore the reasons behind participants' proffered responses whereas with quantitative research a reaction is just a reaction and there is often no insight into what caused or triggered the reaction (Palys, 2003). Quantitative research would be better used in a situation where one is only looking at numbers for example when researching and analysing data to figure out what the new trends are during the holiday seasons, there will be change in the trends from year to year but, using such methods, the researcher is less able to effectively explore the reasons behind such changes. Palys (2003) defines qualitative approaches as

> Research methods characterized by an inductive perspective, a belief that theory should be grounded in the day to day realities of the people being studied, and a preference for applying phenomenology to the attempt to understand the many truths of reality. Such approaches tend to be constructionist. Qualitative researches tend to be cautious about numbers, believing that the requirements of quantification distance us even further from phenomenological understanding we should embrace. (p. 434)

Quantitative approaches are defined as "research methods that emphasize numerical precision; a detached, aloof stance on the researcher's part and, often, a hypothetico-deductive approach" (Palys, 2003, p.434). Quantitative research approaches are often used in an experimental setting, as it would identify the behaviour of change, instead of searching for the meaning of the change (Hay, 2010).

Approach Being Used

The goal of the current research is to find the strengths, weaknesses, opportunities and threats of the Canadian Boreal Forest Agreement and the impacts it will have on natural forest disturbances in the areas being protected. A qualitative approach is the better approach for the current research as there is a need to gain insight and understand the reasoning behind the strengths, weaknesses, opportunities and threats associated with the Canadian Boreal Forest Agreement.

Interviews

There are several ways to collect data for research, such as creating focus groups, participant or direct observation, surveys and conducting interviews. Focus groups are a great way to gather in-depth attitudes, beliefs, and anecdotal data from a large group all at the same time; this can also be used to comb out the details of the less-in-depth information provided by surveys. With the strengths of doing focus groups there are also weaknesses, such as time required to identify and facilitate focus groups, and all members need to be participating within the focus group to get the best result from the group. Direct and participant observation techniques are a great way of conducting research when looking at behaviors, but often this type of data collection is very time consuming and is less-well-suited to the needs of the current

research. Surveys are another way of collecting data. These are quite effective for collecting brief written responses on attitudes and beliefs and can employ both open-ended and close-ended questions. Surveys can be done online or in written form and direct contact with participants is not required with this form of data collection. Using surveys for data collection, however, has several drawbacks. Participants' responses will, by design, all be related only to the questions posed. Also, the spectrum of surveyed individuals could be big and several responses may not be from the desired demographic depending on the purposes of the research, and only a percentage of surveys sent out will be returned. For this research the method of data collection that will be used is interviews because it is a great approach to gather in-depth attitudes and beliefs from individuals. There is one-on-one contact during interviews which may result in more in-depth and detailed responses to each question, also interviews will allow for the opportunity to explore questions in greater detail (Fisher et al., 2005).

Interview Justification

For the current study, interviews will be the form of data collection used, because of the more-personal level of interaction with participants allowed by this method. For the interviews there will need to be at least one interview with each party involved with the Canadian Boreal Forest Agreement. Interview sampling should be representative of the range of backgrounds and thoughts on the agreement (Mason, 1996). The Canadian Boreal Forest Agreement includes a large number of companies representing industry, several groups comprising the ENGO segment of interests, and (in this province at least) the Provincial Parks and Natural Areas Division is also engaged in the CBFA initiative. The current study does not set out to gather and analyze information that can be considered statistically representative of each of the three interest sectors as such an undertaking is well beyond the scope of this research. The research design and associated data collection will, however, solicit information from each of the three distinct interest sectors involved in the CBFA initiative in this province. Research will not be directed towards representing any one of the involved parties; instead the interviews will be done to get a snap shot of each party involved to show an overview of the whole agreement from every angle involved. Interviews will therefore be conducted with local representatives of the industry interest sector, the ENGO interest sector, and relevant provincial government departments. At the local industry sector level, there is Corner Brook Pulp and Paper, owned by Kruger Inc., which is a signatory to the CBFA. Kruger Inc. is a company that strives to be at the top in what they do, while being environmentally conscious about their operations.

> Ever since it was created back in 1904, Kruger Inc. has distinguished itself internationally by reinventing itself over the years and positioning itself as a leader in the industry sectors in which it operates. It is active in such traditional industry sectors as pulp and paper, forest products, and containerboard and packaging. Kruger Inc. is now also a major player in renewable energy, tissue products, wines and spirits, and recycling. (Kruger, 2013, 1)

To solicit views of the ENGO interest sector, interviews will be conducted with local representatives of the Canadian Parks and Wilderness Society (CPAWS). CPAWS is interested in protecting land areas to ensure they are there in the future, by working collaboratively with the communities affected to come an agreement. CPAWS can be described as:

> Canada's voice for wilderness. Since 1963 we've led in creating over two-thirds of Canada's protected areas. That amounts to about half a million square kilometres – an area bigger than the entire Yukon Territory! Our vision is that Canada will protect at least half of our public land and water. As a national charity with 13 chapters, 60,000 supporters and hundreds of volunteers, CPAWS works collaboratively with governments, local communities, industry and indigenous peoples to protect our country's amazing natural places. We're also on guard to ensure that our parks are managed to protect the nature within them. (CPAWS, 2013, 1)

The CBFA is an agreement with environmental groups and industry, and without some form of government involvement in final decisions, there is no real formal binding agreement. In other words, unless the areas set aside to be protected are designated protected areas by the Parks and Natural Areas Division of the provincial department of Environment and Conservation.

Due to time restraints, the interview questions for this research were sent by email to the representatives of each of these interest sectors and they provided written responses. To date, responses have been received from the industry and environmental group interest sectors but no response has been received from provincial government representatives. As well as interviews, there is an in-depth review of relevant literature of forest disturbances to aid in the analysis.

Literature Review

Natural disturbances and climate change

Canadian forests are a major part of the country. Out of a total land area of approximately 922 million hectares, approximately 418 million hectares of that are forested (Thormann, Bernier, Foster, Schindler, & Beall, n.d.). Hand in hand with this large area of forest are large-scale forest disturbances. Forest disturbances can be divided into two general categories: natural and anthropogenic. Natural disturbances include occurrences of pest outbreaks, wildfires, wind throw, floods, landslides, and avalanches. While anthropogenic disturbances also include human-caused fire, wind throw, and logging. Logging or clear cutting for development or commercial logging results in areas of land being cleared which consequently makes the surrounding forest more susceptible to wind throw. While forests that are untouched are also susceptible to wind throw, the chances of it happening are much lower than that of an area that has been cleared.

Global climate change has been accepted as a cause of rising the mean global temperatures and the largest current increases are found in the upper latitudes of the northern hemisphere where the boreal forest is located (Soja et al., 2007). Increasing temperatures would have several different effects on forest disturbances. Insect outbreaks will happen more frequently in more northern parts of the boreal forest, and because insects migrate faster than the trees, there is expected to be an increase in non-native insects throughout the boreal forest (Dale et al., 2001). Fire is also expected to increase in frequency, and intensity, as global climate change continues (Soja et al., 2007). Natural disturbances are a natural part of any forest ecosystem, and they aid in essential processes that happen naturally in the boreal forest, but with climate change, forest are going to experience rapid alterations (Dale et al., 2001). Protected areas will have increasing importance during shifts and changes regarding the climate, as they provide natural corridors for flora and fauna to move through as the climate shifts over time.

In protected areas, human-caused disturbances are less of a threat, unlike the influence of natural disturbances which are maintained in intact ecosystems. Natural forest disturbances

warrant serious consideration in discussions regarding protected areas in Canada's boreal forest. With significant global climate changes already apparent, such consideration is more important now than ever. Environment Canada defines climate change as "Changes in long-term weather patterns caused by natural phenomena and human activities that alter the chemical composition of the atmosphere through the build-up of greenhouse gases which trap heat and reflect it back to the earth's surface" (Archives, definitions 2013, 12). Climate change may increase the magnitude and frequency of natural disturbances in the boreal forest. For instance, increasing winter temperatures could result in increased pest outbreaks (Neuvonen et al., 1999) such as the spruce budworm. The spruce budworm is found in the boreal forest, and can cause considerably more damage than other pests in North America's boreal forest. The spruce budworm is mostly found in white spruce, and balsam fir stands as they are the principle hosts (Volney & Fleming, 2000). All pests found in the boreal forest are sensitive to climatic variables, and rely on specific conditions for development and spreading (Volney & Fleming, 2000). "To date, the majority of results assessing individual pest species' response to climate change indicate intensification in all aspects of outbreak behavior" (Logan et al., 2003 p. 136).

In addition to pest outbreaks, forest fires are also a means of natural disturbance (Logan et al., 2003). Fire is also a climate-sensitive disturbance, and the frequency and intensity are often explained by a changing climate. Fire regimes are changing, and larger areas are becoming susceptible to fire. With climate change and rising temperatures, fuels for wildfires will dry quicker and be more abundant and more extreme weather events could lead to an increase in natural wildfire frequency. Fires can be helpful for forest productivity as well, because the heat of the fire releases plant nutrients some of which are released into the atmosphere in gas form, while others get deposited into the soil in the form of ash (Dube, 2009). Although fire can help by releasing certain nutrients into the soil, it also makes the soil more susceptible to soil erosion. The warmer temperatures of the fire decrease cohesiveness of the soil at the surface as well as decreasing the soil moisture content, the death of trees and decaying tree roots result in a loss of mechanical cohesion and increase the mobility of the soil on hillsides (Dube, 2009).

Wind throw is also a natural disturbance which normally happens in forest strips alongside roads, water bodies, and areas of harvesting (Ruel, 2000). Any type of wind throw due to human influences is considered anthropogenic. Although most commonly wind throw happens because of human disturbance it does also happen naturally due to severe weather and high winds. This type of disturbance is not so much a result of climate change as much as human influence on the natural environment, but climate change will have an influence on the natural form of wind throw because there are expected to be an increase in severe weather patterns, traveling further and lasting longer than in the past. In forest areas that are dominated by fire and insect outbreaks, clear-cutting is generally the preferred method of harvesting mature even aged stands (Ruel, 2003). Clear-cutting areas makes adjacent forest areas susceptible to wind-throw, meaning not only will there be a loss of vegetation and biodiversity in the area clear cut, but these impacts will also push past the boundaries of the harvested area. Due to climate change storms are becoming more frequent and intense (Bengtsson et al., 2006), thus creating greater likelihood that wind-throw will happen more frequently and at a greater extent.

Natural Disturbances and the Boreal Forest

The Canadian boreal forest spans the country in a continuous belt, from Newfoundland and Labrador to the Yukon Territory. Most areas in this belt have a history of repeated episodes of disturbance, from fire, insects, wind, pathogens, and timber harvesting. This has led to

continually changing forest conditions and successional development. Spruce, Pine, Balsam Fir, Western Larch, Tamarack, Paper Birch, and Quaking Aspen are the major tree species that make up the Canadian boreal forest (McCullough et al., 1998).

Fire and insects are natural disturbances in several different forest ecosystems that often include interactions that affect succession, nutrient cycling, and forest species composition (McCullough et al., 1998). In the boreal forest there are five natural disturbance types that initiate succession, they are forest fires, wind throw, snow, gap phase dynamics and browsing can all initiate succession (Niemela, 1999). Wild fires can start from numerous ignition sources, some are human induced, such as sparks from equipment, discarding cigarette butts, or arching power lines while others are natural igniters such as, lightning and spontaneous combustion (Pyne et al., 1996). There are numerous other natural wildfire ignition sources, but they are not relevant in the Boreal forest. There are three different fire classifications: first is surface fires which burn shrubs, fallen tree limbs, and needles and leafs that are laying on the forest floor. The second classification is crown fires, these fires are mostly ignited by surface fires, and burn through the crown of standing trees. The last classification is ground fires, these burn in subsurface organic material, such as organic soils of swamps or bogs (McCullough et al., 1998).

In the boreal forest, insect populations have major impact on the forest, they are one of the dominating disturbances and can cause tree mortality over large tracks of land (Fleming & Volney, 1995). From 1982 – 1987, the annual forest losses due to insects was estimated to be 51.0 million m^3 per year, thus making insect disturbances bigger and more devastating than forest fires, which were 1.5 times lower than losses from insects (Hall et al., 1994). There are several species of insects that affect the Canadian boreal forest such as, Spruce Budworm, Forest Tent Caterpillar, Eastern Hemlock Looper, Gypsy Moth, Mountain Pine Beetle, Spruce Beetle, and many more. Insect outbreaks are processes which take long periods of time to happen. For example the Eastern Hemlock Looper, which mainly feeds on balsam fir foliage, can have outbreaks that last three to six years, but generally have a time span of ten to fifteen years between outbreaks, Furthermore, in outbreaks that have been studied, it has been found that they can cause significant damage in less than half the time span of an outbreak (Hall et al., 1994). Insect outbreaks can have devastating impacts on forest area, and outbreaks leave behind an accumulation of fuels that can help and compliment the ignition of forest fires. Insect outbreaks that are followed by fires can have major impacts on the tree species native to the area, and in some cases can change the main species of tree in an outbreak area (McCullough et al., 1998). Natural disturbances play a major role in the Canadian boreal forest, and contribute to ongoing change through time and with the threat of climate change these impacts are expected to become bigger and more significant to the boreal forest.

Natural Disturbances in Protected Areas

Protected areas all over the world are key to conserving biodiversity. Protected areas also limit land use in the area protected. Protected areas can provide several services such as watershed protection, carbon storage, biodiversity, cultural services, and even recreation (DeFries et al., 2007). The International Union for Conservation of Nature (IUCN) defines a protected area as follows: "a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values" (2008). Some protected areas are easily accessible and could pose issues regarding the sustainability and integrity of those protected areas, as they are more susceptible to anthropogenic disturbances. Now more often now than

ever, disaster specialists are looking at the roles that natural ecosystems play in the big picture, many of these natural ecosystems are found inside protected areas boundaries. Natural ecosystems are being looked at for ways to prevent natural hazards from developing into disasters (Stolton et al., 2008). Natural unregimented ecosystems are able to withstand natural hazards, and sometimes extreme events such as fire, floods, and even small landslides and avalanches. In fact these disturbances are needed to maintain a healthy ecosystem. An example of this would be, fire germinating seeds and providing space for re-growth (Stolen et al., 2008). Despite high levels of protection in protected areas, the changes that are being made outside the protected areas boundaries result in changes in ecological function and biodiversity within many protected areas (Hansen & DeFries, 2007). Unfortunately despite high levels of protection being given to protected areas, several areas are not functioning as planned, and critical ecological processes are being altered, such as fire, flooding, and climate regimes (Hansen & DeFries, 2007). These changes are occurring due to external factors and such changes alter how natural disasters in protected areas react.

How well a protected area maintains ecological function is not static through time as disturbances such as fire, hurricanes and insect outbreaks can alter the functions in different habitats (DeFries, et al., 2007). Altering the lands outside the boundaries of a protected area alters the ecosystem as a whole, making the processes change inside the protected areas boundaries. These changes could also change how wildlife travel through the area and migration routes may change over time.

Canadian Boreal Forest Agreement

In 2010 there were twenty one member companies and nine environmental organizations identified as signatories of the CBFA (Drew, 2010). Today the CBFA includes nineteen members on the industry side and seven members on the environmental group side (CBFA, signatories). This agreement was signed in 2010, and is considered the largest conservation agreement in history that is happening between environmental groups and logging companies. In the past these two groups were not on the best of terms with each other (McDiarmid, 2012). There have been several reasons for the numbers of signatories decreasing since the beginning of the agreement; one example is Greenpeace leaving the agreement. This happened after they had found proof of logging in areas prohibited according the CBFA. Greenpeace released pictures of the area from a logging road that was said to be twenty kilometers past the boundary that was decided on through the agreement. Because of finding proof of the agreement not being followed the environmental group decided to pull out of the agreement in frustration (McDiarmid, 2012). This view is countered by some of the companies which seem to suggest that the Canadian boreal forest has measurably benefited from having people with different perspectives working together within the agreement, and progress has been made for the protection of environmental, cultural and economic values (McDiarmid, 2012). Although after all the disputes about logging inside the agreement's boundaries it was said that all the disputes that have happened will be part of the process as this agreement is something that has not been seen before in the past (McDiarmid, 2012). With the agreement it was believed that it will break down the barriers between industry and environmental groups and the idea of environment versus economy will no longer be as obvious as it was in the past (Willems, n.d.) in the same news article it was stated that having the two groups working together could only come to a good end. Although there have been some disputes, the agreement has achieved some success, such as the CBFA agreeing

to secure a three-million hectare parcel of land in Ontario for the conservation of boreal woodland caribou. While securing this land, they were able to maintain all the forestry jobs in the conservation area and, on the remainder of the land in this jurisdiction, sustainable forestry practices are being carried out (Willems, n.d.). This success shows the balance that is struck between the environmental groups and industry in striving to keep both sides of the agreement happy, while achieving conservation and industry goals that have been set out through the agreement.

Research Findings

From the research that was completed and the interviews that were conducted several strengths, weaknesses, opportunities and threats have been identified which are important to the CBFA. There were three different interest sectors approached for the research, and only the industry and environmental groups have responded. Locally industry was represented by Kruger Inc, and the environmental group was represented by Canadian Parks and Wilderness Society (CPAWS). Both of these groups are signatories of the agreement while the third interest group, the Parks and Natural Areas Division of the Provincial Department of Environment and Conservation, was not a signatory of the CBFA. Even though they are not a signatory of the agreement they are still involved by attending meetings and have some say in what happens with the agreement. It is important to note that when the final decisions are made through the CBFA it is just the industry and environmental groups who are involved and they also get the final say on what happens.

One of the major strengths of the agreement is that it allows industry and environmental groups to work together in achieving both ecological and socioeconomic goals (Industry interviewee), which will assist both groups and shows that the agreement is not directed towards one group more than the other. The agreement also provides a good balance of both economic and environmental needs and challenges that go along with the boreal forest (Industry interviewee). The agreement also has better accountability for the environment than the environmental assessment process because the environmental assessment process has turned to big industry (ENGO interviewee).

There were also several weaknesses of the CBFA which were highlighted by both of the interest sectors. The CBFA can be a slow process in order to correctly accomplish the desired goals (Industry interviewee). Industry has never planned for such conservation measures in the past and as a result they are relying on government for some guidance in this area (ENGO interviewee). While some industry signatories are on board with the agreement and follow all the goals and restrictions put in place, some signatories are resistant to following all the guidelines put in place. Also, while the industry signatories might be fully onboard with the agreement, some sub companies of the parent company might be less interested in the agreement (ENGO interviewee).

The CBFA has numerous strengths and weaknesses, but the agreement also has several opportunities both currently and into the future. The agreement is a way for both environmental groups and industry to continue to work together and build a better relationship (Industry interviewee). The CBFA has a strategic focus on science through scientific advisory bodies, allowing decisions to be made based on science instead of political compromises (ENGO interviewee). A major opportunity for the agreement would be using the model or adopting the model in other industry sectors, for example offshore oil development (ENGO interviewee). The CBFA protected areas could change over time, the CBFA can make be used as vehicle to make

recommendations to the government for the area to be slated as legislated protected areas, making the areas unable to change over time (ENGO interviewee).

Although, changes in the status of CBFA protected areas would be a serious threat to the agreement often threats need to also be considered. The pressure to make the process faster and to provide quicker outcomes (Industry interviewee) could result in not getting proper approval of all the signatories or important bodies. Another threat to the agreement would be companies not honoring the agreement causing some environmental groups to back out of the agreement (ENGO interviewee) as was seen with Greenpeace. There can also be resistance to implementing the proper scientific protocols to ensure that logging is halted in important parts of the forest to sustain habitat for caribou (ENGO interviewee). Another significant threat to the CBFA is that the government is not a signatory of the agreement, but that does not mean that they are totally un-involved with the process because they are seen as playing a big role in implementing some of the potential outcomes. When there are important discussions and decisions to be made the government is left out and the discussions happen between industry and environmental groups (ENGO interviewee). Although without government directly involved the areas set to be protected areas are only recommendations (Industry interviewee), but the government has the power to make these areas an actual protected area that will not change, or cannot legally be logged. Currently there is no formal regulations outside of the CBFA stopping industry from logging areas that are recommended to be protected as the agreement is just between the industry and environmental groups.

In regards to the CBFA helping to mitigate natural disturbance challenges, there was little feedback provided in this area. Although if proper steps are being taken to protect intact landscapes that are valuable then Anthropogenic disturbances should be minimized. The main industry player is making major steps to maintain intact landscapes which should also play an important role in stewardship (ENGO interviewee).

The CBFA also creates a whole new level of credibility for the industry side of the agreement and shows that they are interested in and actually carry out sustainable and responsible forest management practices, which adds to their already world-leading forest management certification status (Industry interviewee).

Conclusion

Sustainable resource management is a difficult goal to sustain and has been for many years now. There are several complex intermingling systems involved (Ewert et al., 2004). Along with the interconnected natural systems there are also human systems that need to be thought about when it comes to resource management (Ewart et al., 2004). The CBFA is doing just that, both interest sectors are looking at the ecological and economic importance of maintaining the integrity of natural systems. As well, both are considering the associated and interconnected human systems. Integrated resource and environmental management is a growing idea, and has been used in continuous resource management contexts all over the world (Born & Sonzogni, 1995). IREM will bring together all the different values and uses of the area needing conservation to come to a solution for complex and ever-growing environmental issues. The CBFA is bringing together industry and environmental groups in order to set aside areas of land as protected areas, for the conservation of caribou habitat.

Natural disturbances also affect the Canadian boreal forest, from insect outbreaks to forest fires, and wind throw from big storms. With the increase in severe storms and warmer

temperatures the dynamics of natural disturbances are shifting. While protected areas are key to conserving biodiversity and protecting wildlife habitat, protected areas also limit land use and protect ecosystems from surrounding human dominated landscapes. Protected areas also play a vital role in watershed protection, carbon storage, biodiversity, cultural services, and sometimes recreation (DeFries et al., 2007). Natural ecosystems have ways of adapting to withstand natural hazards and even extreme events such as fire, floods, and small landslides and avalanches. Natural disturbances are needed to maintain a healthy ecosystem (Stolen et al., n.d.). Protected areas are still susceptible to natural disturbances, although altering the land surrounding a protected area can also alter the ecosystem as a whole, making the natural processes change inside the protected areas.

The SWOT analysis that was conducted on the CBFA has shown that there are several different strengths, weaknesses, opportunities and threats. Strengths consist of the industry and environmental groups working together to achieve both ecological and socioeconomic goals which are helping both parties involved equally. The agreement also provides a balance between economic and environmental needs which, in the long run, will help both industry and environmental groups achieve their goals. There were also weaknesses of the agreement, such as the long process to achieve the desired goals, and the fact that industry has not planned for such conservation measures in the past and that not all parts of the industry companies are as interested or dedicated to the agreement as others. Opportunities of the agreement are that the environmental groups and industry get to continue to work together and create better relationships with each other. As well the model accounts for the environment better than other models that are used, and could be adapted and used for other conservation measures and resource sectors. The threats of the agreement consist of the pressure to speed up the process and the fact that industry could dis-honor the agreement during difficult economic situations because not all the areas set to be protected areas are slated as protected areas by government, they are only deferrals which will possibly be established as formal protected areas. The CBFA also creates a whole new level of credibility for the industry side of the agreement showing that they are interested in conducting sustainable and responsible forest management practices. The CBFA is a new type of agreement that has not been attempted before, and because of that there are going to be several strength, weaknesses, opportunities, and threats as there is with other existing agreements.

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Social Impacts of Large-Scale Natural Resource Development in Canada's Northern Indigenous Communities

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Introduction

> Northern peoples have always expressed concerns about the "sustainable development" of their land, water, and natural resources, as well as other human impacts on the natural environment (Natural Resources Canada, 2003).

Although much of Northern Canada has remained undeveloped, the increase in demand for natural resources worldwide has resulted in expanding exploration of Canada's northern landscape. Many new discoveries have been made across the country in the last decade, disrupting cultures and livelihoods of hundreds of indigenous communities. The outcome of discovering and developing natural resources may sometimes be beneficial to local communities. It often creates a wide range of opportunities such as employment, education and, in some cases, an increase in cultural diversity. There are, however, many negative effects associated with resource development. Pollution, habitat degradation and some social impacts on local people are all examples of the negative consequences of large-scale development projects.

While much has been written on the environmental impacts of natural resource development (Harris, 2012 ; Labohm, Rozendaal, & Thoenes, 2004), substantially less has been written on the social impacts that result from large-scale projects (Houghton, 2009), especially in Canada's remote, northern areas. Given the increasing demand for resources (Houghton, 2009 ; Zatzman, 2012), and the consequent increase in the number and scale of development projects (Carmin & Agyeman, 2011; Mitchell, 2010), it is imperative that the social impacts be explored more fully.

The current paper will focus on the social impacts, both positive and negative, that occur as a result of large-scale natural resource development projects. The scope for this research will be limited to case studies focusing on indigenous communities in Northern Canada, ranging from British Columbia to the Labrador portion of the province of Newfoundland and Labrador and also the Northwest Territories. I have chosen to focus on indigenous communities in Northern Canada for two personal reasons. One, because I am myself a permanent resident of a small town in Southern Labrador and a member of the Labrador Metis Nation and two, because indigenous cultures are both spiritually and emotionally connected with the natural world. Therefore, the social impacts felt in these isolated communities due to the exploration of the land are far greater than those of the western developed world.

I have chosen a qualitative research method of case studies to identify and to gain a better understanding of the social impacts typical of natural resource development in these remote areas. I will also present two strategies that may be useful to help mitigate future impacts in indigenous communities. The first is a newly developed methodology that uses cost-benefit analysis which can be used by large corporations to benefit both income and the environment. The second is a new approach for our current education system, one which recognizes the beliefs and values of indigenous people and uses the traditional ways of teaching and learning in the north.

Rationale

> "Sustainable development" in a northern context is essentially about managing the North's wealth of renewable and non-renewable resources, taking into consideration the social, economic, and environmental factors now and in the future (Natural Resources Canada, 2003, pg. 4).

Resources are such things as forests, wildlife, oceans, rivers, lakes, minerals, and petroleum (Deardon & Mitchell, 2009). These resources are divided into two groups: renewable and non-renewable. Renewable resources are those that may replenish themselves over a period of time such as trees and fresh water. Non-renewable resources have an finite supply and include: fossil fuels, natural gas, coal, and minerals. They are not capable of being replenished, except with deep time, and cannot be reused once used (Oxford University Press, 2014). Renewable and non-renewable natural resources are extremely important in today's society. The demand for these resources has been growing rapidly, as our total population continues to increase at an exponential rate. This demand is met by continuous research of new methods to find and extract new sources of raw materials. Both the frequency and intensity of natural resource development has increased, especially in isolated, sparsely populated areas (Dinsdale, White & Hanselmann, 2011). The push for economic growth, however, ensures that, for now at least, this demand is met, regardless of its consequences.

The extraction and processing of natural resources has significant environmental impacts that have been well studied and documented (Dinsdale, White & Hanselmann, 2011, Anderson & Bone, 2009). Despite these documented impacts, the number and scale of natural resource development sites has continued to increase. In recent years, however, with mechanisms like Environmental Impact Assessment, measures have been taken to try to forecast potential impacts and to develop mitigation strategies.

Northern Canada consists of many small, sparsely populated communities, which represent a wide range of unique cultures. These cultures are often closely tied with the natural environment. These small communities can be found from Canada's west coast of British Columbia to the east coast of Newfoundland and Labrador and also the northern territories. Canada borders the United States of America to the south, which has contributed to greater economic development of the southern portion of the country. Much of Canada's north, however, has been left undeveloped, but is occupied by a small population of indigenous peoples. The communities here are vulnerable and extremely sensitive to resource development, which leads to greater social effects in these areas. One area, in particular, experiencing significant environmental and social impacts related to natural resource development is the Labrador portion of Canada's most eastern province, Newfoundland and Labrador.

Nalcor Energy is leading the world-class Muskrat Falls hydroelectric development on the lower Churchill River in Labrador (Nalcor Energy, 2014). The project includes the construction of an 824 megawatt (MW) hydroelectric dam, and more than 1,500 km of associated transmission lines that will deliver electricity to homes and businesses in Newfoundland and Labrador (Nalcor Energy, 2014). According to Nalcor Energy, the project has been intensely studied, and there has been significant stakeholder engagement and public input into the project planning process (Nalcor Energy, 2014). More than 35 years of studies have been undertaken to ensure that this project is developed in a way

that is both environmentally and economically sustainable (Nalcor Energy, 2014).

Despite the claims made by Nalcor, there are many potential environmental impacts associated with this project such as effects to the physical landscape, water resources, animal habitat and animal migration patterns. Numerous projects in forestry, mining or hydro, including the development of the lower Churchill, are proposed or underway within major caribou habitat areas (Department of Environment and Conservation, 2010). For example, caribou herds, such as the George River caribou herd in Labrador, travel thousands of kilometers each year. Changes can be seen over the years in migration patterns, and now caribou are traveling into areas that are very accessible by hunters, especially along the newly developed Trans-Labrador Highway (Department of Environment and Conservation, 2010). Impacts to water resources with regard to Muskrat Falls include the altering of direction and volume of water flow. For example, the head waters above the dam site will change from many ponds, lakes and streams to one large water body. This will affect the fish species, birds and animals that once occupied the newly flooded land. This area is also home to several groups of indigenous populations. Here, people live off the land, and use its resources for shelter and food. The sensitivity and vulnerability of some local aboriginal groups requires the need to address social impacts and to develop proper mitigation measures to protect local people. "Social problems such as alcohol and drug abuse, child neglect and violent deaths, require a specially designed study to properly address these issues" (Lang, 1990, p. 123). Measures need to be taken to mitigate these impacts, to promote creative and more effective decision making. Figure 2 below shows the Community Well-Being (CWB) of both indigenous and other Canadian communities, for a 5- year census period. As can be seen, other Canadian communities, represented by the green line, has a CWB index much higher than both first nations and Inuit communities.

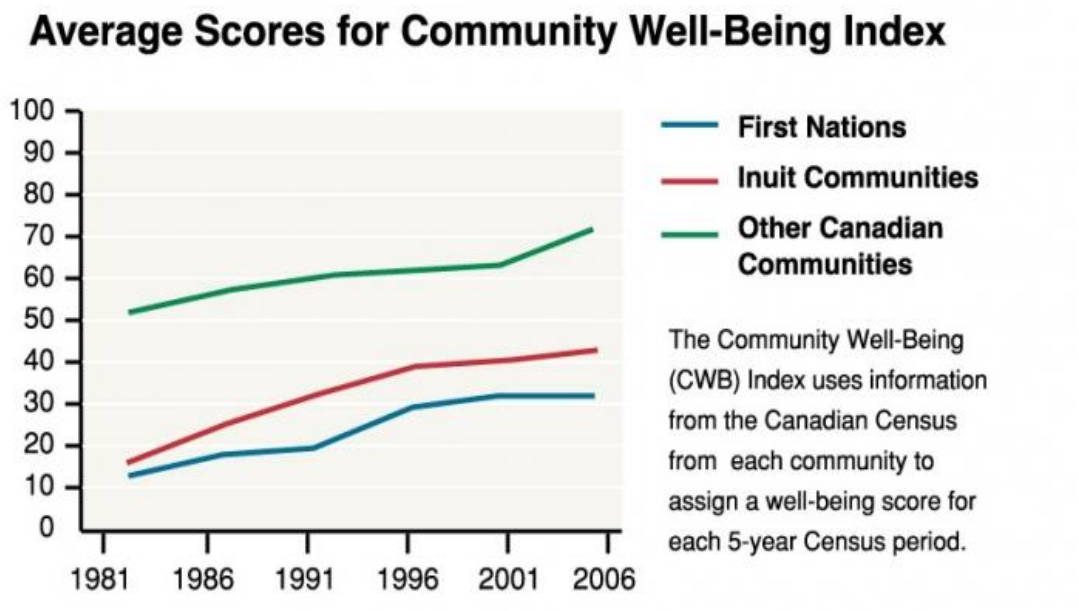

Figure 1. Community Well-Being

Future development of natural resources will continue to spread to other parts of the country, and expose many other indigenous communities in the north. Significant research and cooperation between all levels of government and the public is required in order to lessen the effects of these developments. Integrative Resource Management identifies key, interrelated dimensions or areas for integration: disciplines, information, spatial/ecological units, governments, agencies, interests and sectors. This type of management ensures that the public is involved in decision-making and may be used in future development decision-making to help mitigate future impacts on indigenous communities.

Literature Review

Over the past three decades, international institutions such as the International Monetary Fund (IMF), World Bank, and associated regional development banks outside of Canada, have actively promoted and financed the liberalization of the hydrocarbon, mining, and timber extraction sectors of national economies across the globe (Sawyer & Gomez, 2012). These same institutions have also followed the merits of public-private cooperation as a means to sensitize businesses to the problems that accompany such extraction projects (Sawyer & Gomez, 2012). Private-public collaborations among governments, multinational corporations (MNCs), and international financial institutions (IFIs) will enhance social well-being by eradicating poverty, promoting sustainable forms of economic development, and protecting the environment (Sawyer & Gomez, 2012). Although these claims have been made by many corporations, in reality, minimum efforts and actions have been taken to reduce negative impacts.

In 2010, Canada was one of the top ten producers of non-fuel minerals in the world and stands behind Australia and China in terms of economic value (Lucas, Lloyde & Allen, 2010). In Canada, the mining industry produces a wide range of minerals by employing a variety of technologies major mineral extraction projects, are able to operate in the nickle/copper operations in Sudbury, Ontario, diamond mines in the Northwest Territories, and the vast oil sands operations in Fort McMurray, Alberta. Natural Resources Canada (NRCAN) is a world leader in mineral exploration and production, expanding well beyond national boundaries (Lucas, Lloyde & Allen, 2010). These developments generate economic wealth for the nation, but they come with a price including effects on air, water, food chains, and wildlife migration patterns, physical landscapes, and local cultures, particularly those of indigenous peoples (Lucas, Lloyde & Allen, 2010).

1. Increase in Demand

Throughout the world, people earn their livelihoods through the use of whatever resources are available to them. Therefore, it may be said that "our livelihoods are ultimately natural resource dependent" (Harris, 2012, p. 135). Natural resources provide us with the land, trees, saltwater and freshwater resources, wildlife, oil, gas, and mineral resources (Harris, 2012).

The population of our planet is increasing at an exponential rate and now exceeds 7 billion. The richest 20 per cent of the world's population, however, are responsible for more than 75 per cent of world consumption, while the poorest 20 per cent consume less than 2 per cent (Deardon & Mitchell, 2009). As our human population continues to grow, our production of renewable and non-renewable, natural resources for the necessities used in life grow as well, as can be seen in Figure 2. Production has grown extensively through the 20th century, enabling us to produce products of all kinds to make our life easier and our leisure time more interesting and entertaining (Henderson, 2010).

Within only the first 20 years of the 21st century, people have used the same amount of resources that were used between 1950-2000 (Henderson, 2010). To worsen the situation, resource depletion is expected to accelerate as developed countries want more and more products. Furthermore, developing countries, such as China and India, have a combined population of nearly 3 billion (Henderson, 2010). With the growth of these heavily populated countries, it is expected that in the next 50 years, we will use three-to-five times the total amount of resources consumed in the second half Of the twentieth century (Henderson, 2010)

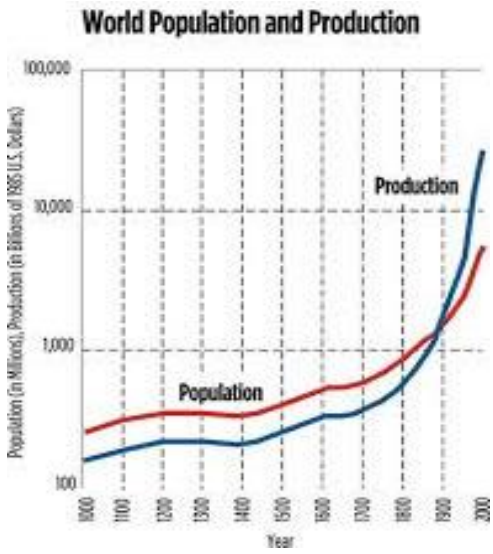

Figure 2. Increase in world population and production.

For example, energy is provided so easily in the developed world that thought is rarely given to where it comes from, whether it will ever run out, or whether it is harming the environment or not (Houghton, 2009). Energy is also so cheap that little serious attention is given to consuming it (Houghton, 2009). Until the Industrial Revolution, energy for society was provided from "traditional" sources such as wood and other biomass and animal power (Houghton, 2009). Since 1860, the growth in industry has increased the rate of energy use by about 30 per cent or more, first mostly through the use of coal, followed by oil and natural gas (Houghton, 2009). In 2005, the world consumption of primary energy was about 11,400 million tons of oil equivalent (Houghton, 2009).

2. Environmental Impacts

"Wasters, polluters, and those who do not care for the environment or are unable to adapt would only fall behind to see the fate of the dinosaurs" (Henderson, 2010, p. 11). Human's activities on earth has expanded globally and it has become clear that natural systems such as the atmosphere, land and sea as well as life on this planet are being disturbed due to these activities (Bolin, Jager, & Doos, 1986). For example, traces of natural gases, such as methane (CH4), carbon dioxide (CO2), and nitrous oxide (N2O) as well as other gases have increased in the atmosphere (Bolin, Jager, & Doos, 1986). Major terrestrial biomes are changing and significant changes can also be seen in marine systems on a global scale (Bolin, Jager, & Doos, 1986).

Environmental issues have been a concern for many years. Yet, somehow these are problems that we have not been able to resolve, despite research, media attention, increased public awareness about the environmental problems, campaigns by environmental pressure groups, and international agreements (Harris, 2012). Strong evidence of biodiversity loss, land cover change (observable from satellite imagery), climate change and many examples of pollution, have been recorded, yet we still pursue activities which perpetuate the problems (Harris, 2012).

To measure and compare our individual, community, regional, or national effects on the environment, "ecological footprints" are used to link human lifestyles with environmental impact (Harris, 2012, p.7). "Ecological footprint" may be defined as "the area of ecologically productive land and water in various classes, cropland, pasture forests, that would be required on a continuous basis to (a) provide all the energy/material resources consumed, and (b) adsorb all the wastes discharged by the population with prevailing technology, wherever on Earth that land is located" (Harris, 2012, p. 7). The

water footprint of a nation is similar to the ecological footprint, but only calculates the water required to produce food and other products for consumers (Harris, 2012) For example, the average water footprint for a country is 1240 m3/person/year, ranging from 700 m3/person/year in China to 2480 m3/person/year in the USA (Harris, 2012). For example, the oil sands operations in Alberta, used approximately 170 million cubic meters of water in 2011, equivalent to the residential water use of 1.7 million Canadians (Pembina Institute, 2014).

3. Social Impacts

A number of international institutions, including the United Nations (UN) and several multilateral development banks, have voiced concern over the adverse impact of resource extraction activities on the livelihood and culture of indigenous communities (Sawyer & Gomez, 2012). In response to such concerns, a number of international agencies and governments have introduced charters and legislation to protect the rights and well-bring of indigenous peoples (Sawyer & Gomez, 2012). Even so, the scale and scope of the problems indigenous peoples are confronted with as a result of resource extraction projects endorsed and funded by Multi-National Corporations (MNCs), governments, and IFIs is monumental, even "baffling" (Sawyer & Gomez, 2012).

The lives of people living in Canada's north have always revolved around the land and ocean. Although it is not clear what sustainable development means, in the northern context it is essentially about managing the North's wealth of renewable and non-renewable resources, taking into consideration social, economic, and environmental factors now and in the future (Natural Resources Canada, 2003). In other words, ensuring that as economic development occurs, development takes into account the impact on people and their communities, as well as on the environment (Natural Resources Canada, 2003). In Canada and elsewhere around the world, indigenous peoples are struggling to rebuild their nations and improve the circumstances of their people (Anderson, MacAulay, Kayseas, & Hindle, 2009). First nations are a "not-quite conquered people" that are surrounded by a growing, resource hungry non-native population (Booth & Skelton, 2004). In recent years, indigenous peoples have stood up and fought for their rights, protesting against development companies and governments (VanNijnatten & Boardman, 2002). The subject of first nations' rights and access to resources is very complex. To first nations peoples, the concept of land is "home" (Booth & Skelton, 2004). This statement is only one of the sources of conflict and uncertainty over first nations' access and rights to natural resources (Booth & Skelton, 2004) "In reality, native individuals or his or her community is forced to separate from the land by white society" (Valandra, 2004, p. 2). This results in negative spiritual, cultural, social, political, and economic impact on an individual or community. Thus, native land tenure has a spiritual element driving most native people's land claims (Valandra, 2004). To first nations people, land and resources are far more than merely something to exploit, as is often the case in non-native society (Booth & Skelton, 2004). This differs from the western point of view, as when Europeans discovered North America they believed they could own land privately which is in conflict with the native belief system of land ownership. This was largely due to John Locke's philosophy which entitled Europeans to take the land from indigenous peoples (Cororan, n.d.). However, " John Locke's Second Treatise of Government (1690) has been widely condemned by contemporary scholars for devising a seductive new ration to promote English colonial expansion in the new world (Cororan, n.d, p. 2).

Although there has been considerable research done on environmental impacts, research on social impacts has been inadequate. The following is an example of how monitoring surveys fail to capture the real social problems existing in local communities. In this example, the community was affected by a large oil pipeline project known as the Norman Wells pipeline. The Department of Indian Affairs and Northern Development's social-economic monitoring program gathered most of its data from an annual survey of all households, businesses, and public agencies (Green & Bone, 1990). The data was collected by using a simple questionnaire. The questions were very general, but aimed to

collect basic data useful in measuring socio-economic changes of the community caused by the Norman Wells Oil Development and Pipeline Project. However, only the main social activities and occupations of household members were queried. Sensitive family and community problems, such as alcohol and drug abuse, were not found in the household questionnaire (Green & Bone, 1990). This indicates that the Department of Indian Affairs and Northern Development was not interested in gaining in depth knowledge of social impacts created by development.

It is evident that the federal government is incapable of dealing with social impacts to indigenous communities. This can be seen in the relocation of Sheshashiu in Northern Labrador. This community was severely impacted by alcoholism, poverty and suicide and moved to Natuashish by the federal government. Recently, the same social problems have again emerged in Natuashish (Clancy, 2004). This may been seen as evidence of the government's lack of commitment and knowledge of how to fix the social problems found in indigenous communities.

4. Injustice

Traditionally, justice was referred to as "the appropriate division of social advantages between people over time (Anguelovski & Roberts, 2011, p. 20). Justice scholars are now concerned with issues beyond the question of fair or unfair, such as identity and difference between groups of people and individuals (Anguelovski & Roberts, 2011, p. 21). Unfortunately, the conceptions of justice tend to differ according to individual and collective values and preferences (Anguelovski & Roberts, 2011, p.21). The concept of spatial justice offers "a means for understanding the presence of climate inequalities between and within countries, as well the claims of governments and activists for climate justice" (Anguelovski & Roberts, 2011, p. 21). Spatial justice is defined as:

> the equitable allocation of socially valued resources such as jobs, political power, income, social services, and environmental goods in space, and the presence of equal opportunities to make use of these resources over time. (Anguelovski & Roberts, 2011, p. 21)

A "dialectical dynamic" is present at the center of spatial injustice, which occurs at a variety of scales. For example, social exclusion and poverty often result in rural-urban migration and the subsequent growth of slums on the outskirts of sites (Anguelovski & Roberts, 2011). Focusing on social impacts of large scale natural resource development, it is clear that justice is lacking in indigenous communities. Large corporations have billions of dollars, which looks good in government eyes. At the expense of thousands of lives, communities, cultures, as well as the environment, large scale natural resource development projects are increasing in number and scale.

Benefits and Opportunities of Development

According to Lemieux, Canada has more large mineral exploration companies than any other country and is sometimes referred to as "the hub for mining activities worldwide" (Dearden & Mitchell, 2009). About 80 per cent of Canadian mineral and metal production is exported. In 2006, minerals and mineral products accounted for almost 17.5 per cent of total exports for the nation and contributed to its trade surplus (Dearden & Mitchell, 2009).

The word "Impact" has the negative connotation of "some element of destructiveness" associated with it (Batteke, 1990). This connotation distorts the reality of the situation because it looks at only one side of the effects. Native peoples have experienced, and will continue to experience significant changes in their communities, and it is clear that the oil companies working in or near those communities play some part in effecting these changes (Batteke, 1990). The point is that not all of these changes are necessarily bad for the communities (Batteke, 1990). Change itself is a fact of life, and we cannot hope nor expect to be able to freeze time at any point that we desire (Batteke, 1990).

Although there are many negative impacts associated with large scale natural resource development, there is, however, another side of these resource developments (Batteke, 1990). On the positive side, these developments contribute to greater economic independence of the region and its communities through participation in projects and the associated acquisition of incomes, marketable skills in business and employment, and strengthening of self-confidence and self-reliance (Batteke, 1990).

Other benefits and opportunities involved with natural resource development include; sponsorship of community events, improved services and standard of living, increased access and cheaper goods (Land, 1990). In some cases, project impacts may have no effect on such things as: hunting and trapping, town services, and no change in liquor consumption or crime (Land, 1990).

Research Process and Methodology

Qualitative and Quantitative Approaches:

"Communication is the most basic form of human interaction. Groups, institutions, organizations and nations exist by virtue of communication and cease to exist once communication is disrupted" (Holsti, 1969, p. 42).

There are two approaches available to social scientists for research in many areas of human geography; qualitative and quantitative research methods. Quantitative approaches are measured by the quantity of something rather than its quality (Oxford University Press, 2014). Foe example, this method may be used to collect information and data in the form of digits to find the total number of people in support of a particular event. Qualitative approaches, in a broad sense, are concerned with elucidating human environments and experiences within a variety of conceptual frameworks (Hay, 2010).

Contemporary human geographers study places, people, bodies, discourses, silenced voices, and fragmented landscapes (Winchester & Rofe, 2010). Today, research questions presented to geographers require a multiplicity of conceptual approaches and methods of inquiry (Winchester & Rofe, 2010). Increasingly, qualitative methods are used, to elucidate human environments, individual experiences, and social processes (Winchester & Rofe, 2010). Qualitative research methods include; interviews, participant observation and case studies (Hay, 2010). The fundamental questions qualitative research is concerned with is either social structures or individual experiences (Holsti,1969).

Qualitative methods focus on two fundamental questions concerned with social structures or with individual experiences (Hay, 2010). Additionally, qualitative research analyzes social, cultural, economic, political and environmental structures (Hay, 2010). Structures may be defined here as internally related objects or practices Therefore, I have chosen to use a qualitative approach to observe the social effects on indigenous populations from the development of natural resources.

Researching social impacts requires the use of a qualitative research method. Therefore, I have chosen to use a case study approach to examine the social impacts related to large scale natural resource development. A case study may be defined as; an intensive study of a single unit for the purpose of understanding a larger class of similar units. (Baxter, 2010, p. 81)

Case study research involves the study of a single instance or a small number of instances of a phenomenon in order to explore in-depth nuances of the phenomena and the contextual influences on and explanations of that phenomenon (Baxter, 2010, p. 81).

Case Study Justification

Case study methodology is a powerful means by which to both understand the concrete and practical aspects of a phenomenon or place and develop theory (Baxter, 2010). Case studies have a long and rich history in the social sciences and geography, and are valuable because "when done well, they produce deep, concrete explanations of social phenomenon that are attentive to a variety of contextual influences at various scales" (Baxter, 2010, p. 95). It is important to recognize that although a case study may only involve a sample of one, a carefully chosen and well-studied case can be used to

produce very robust, credible, and trustworthy theoretical explanations (Hay, 2010).

I have chosen six case studies from across Canada to show the history of conflict that has resulted from large scale resource extraction in indigenous communities. While the first case study is a century old, it emphasizes the inability of the federal government to effectively deal with indigenous land issues, rights, and access to resources. I have used this case study to revel that these types of issues have been improperly addressed for many years and still continue to exist.

Case Study Findings

Although much of Southern and Western Canada is industrialized, much of Northern Canada, including east coast of Labrador have remained pre-industrializied, with a local economy comprising of subsistence and commercial fishing, trapping, and hunting and periodic-wage laboring jobs and various forms of transfer payments such as employment insurance (House, 1982). Intensive developments such as those taking place in the Labrador portion of the province of Newfoundland and Labrador may potentially contribute significantly to coastal communities. These intense developments such as Muskrat Falls hydroelectric development and Voisey's Bay nickel mine, require a lot of labor and therefore increase employment as well as raise the material living standards while upgrading skill levels and improving community services and amenities (House, 1982). Negative impacts, however, especially societal, need to be examined closely.

The following sections are summaries of case studies that document developments in a particular community or a group of communities during a defined time period. The objective is to familiarize the reader with a broad range of community patterns which have resulted from the impact of large-scale industrial development. Communities in northern Canada have been ignored of basic human rights, proper access to resources, and have had their culture put into jeopardy numerous times throughout Canada's history. Similar cases, and much more extreme cases, can still be found today in many small, urban, isolated communities (Bowles, 1982, Sawyer & Gomez, 2012).

Although there are many sad cases of social discomfort and disruption, there are also, many cases of successful petitions, campaigns, and groups formed by local people to fight for human rights and rights over the land. In some cases, the push and determination of locals have stopped billion dollar projects, which proves the mobilization of the people even when they lack traditional “western” knowledge.

Case Study One
Cobalt, Ontario (1903-1914)

The government of Ontario's decision to build a colonization railway from North Bay to New Liskeard, led to the initial discovery of silver in 1903 (Bowles, 1982), during the construction process of the Temiskaming and Northern Ontario (T. & N.O.) Railway (Bowles, 1982). The discovery was located at the south end of Cobalt Lake, approximately two hundred and fifty miles north of Toronto (Bowles, 1982). The “boom” was expected to be temporary, which resulted in little concern for long-term consequences of action (Bowles, 1982). The silver deposits, however, attracted over twenty thousand people to the area, many of whom, lived in a small “tented city” that formed on the west bank of Cobalt Lake (Bowles, 1982). Major organizations such as T. & N.O. Railway, Coleman Township Council and several mining companies pursued their own interests (Bowles, 1982). There was no unified authority policy to guide the development of the community (Bowles, 1982).

Problems first confronted the citizens of Cobalt in early August, 1905, when ninety-six residents of the township petitioned the Minister of Public Works, arguing that although the population in the area had expanded rapidly, there was still a lack of adequate roads (Bowles, 1982). It was not until 1907, however, that the transportation needs of the various mining companies were adequately met (Bowles, 1982), but road conditions remained poor in the actual townsite (Bowles, 1982). The

continued growth of Cobalt was unplanned, and normal procedures were not followed during the initial stages of development. The most serious problem of this unplanned growth of Cobalt was the absence of suitable sewage and drinking water facilities, and the lack of proper firefighting equipment (Bowles, 1982). The provincial Medical Inspector visited Cobalt during the summer of 1905 and was shocked by the absence of the most rudimentary sanitary precautions, how garbage was carelessly dumped in the townsite, and that there was one proper toilet for every twenty-five citizens (Bowles, 1982).

It was also discovered that Cobalt Lake itself was infected with intestinal bacteria (Bowles, 1982). A year later, the inspector returned to Cobalt Lake to find the situation "if anything, worse" (Bowles, 1982, p.122). July, 1909, a typhoid epidemic swept through the town, catching Cobalt off guard and unprepared. There was only one hospital in the area, so the town constructed several military hospital tents at the north end of Cobalt (Bowles, 1982). "Despite numerous complaints, the citizens realized of Cobalt that their livelihood depended upon the success of the silver mines" (Bowles, 1982, p. 125). Today, Cobalt looks much the same physically as it did in 1914, but many of its two thousand citizens rely on government assistance (Bowles, 1982).

Case Study Two
Coppermine, Northwest Territories (1972)

Inuit communities in the Northwest Territories face a growing dilemma of rapid population growth, with growth rates up to 3 per cent a year (Bowles, 1982). Coppermine is one of three communities in the Northwest Territories which has extensive experience with commuting employment (Bowles, 1982). From November 1972 to May 1977, men from Coppermine were employed by Gulf Oil Canada in its exploration program in the Mackenzie Delta (Bowles, 1982). Data for this case study consist of formal interviews of workers, non-workers and their families, and unpublished data from a variety of sources, including the following: information on work periods, illness, injuries, and social assistance payments (Bowles, 1982).

At Coppermine, before the Gulf Oil Canada program started, the only work available was local community services, and a small number of seasonal construction jobs (Bowles, 1982). Very few people had experience with wage employment, and most over the age of twenty-eight knew little or no English (Bowles, 1982). The new arrangements of being employed by Gulf Oil required Coppermine Inuit to work twelve hours a day for fourteen days at a Mackenzie Delta work site, followed by a seven-day rest break in Coppermine (Bowles, 1982). This was seasonal employment, operating from November to May. Ratings of Coppermine workers at the job site showed that forty-four per cent of the Coppermine workers were rated excellent or good, forty-six percent were rated average, and eight per cent were rated below average (Bowles, 1982).

Data was obtained dealing with "five of the most traditional subsistence activities of the Coppermine Inuit; caribou hunting, seal hunting, trapping, removal to spring resource harvesting camps, and carving and handcraft production" (Bowles, 1982, p. 182). Information on the emotional costs of the employment on workers and family members show that there were many families experiencing "loneliness" (Bowles, 1982). The data from the social assistance payments to Coppermine residents shows that there was a "very substantial increase in the volume of payments during a number of employment years" (Bowles, 1982, p. 191). Further research include: crime rates which found a 500 per cent increase in conviction in Coppermine in 1977, and school retention: which found that there was also an increase in early dropouts during the employment years (Bowles, 1982).

Case Study Three
Norman Wells, Alberta (1984)

Starting in early 1982, preparation work began at Norman Wells with extensive quarrying and heavy truck traffic. The most intensive construction lasted until the fall of 1984, when 90% of the

project had been completed (Lang, 1990). At the peak of construction, less than half of the total population were permanent residents (Lang,1990). A single survey was the only opportunity for residents of four local communities to rank both the positive and negative impacts of the Norman Wells Project (Lang, 1990). This data was collected and used to produce "impact factors for a detailed questionnaire known as the Project Impact Survey 1984" (Green & Bone, 1990).

The highest ranked positive impacts included: "the need for more jobs" as number one, "provided jobs and training" (2), followed by "other positive effects" (3) and "increased business" (4) (Lang,1990). Oddly enough, the positive impact of "need for more jobs" also ranked number one for the negative impacts associated with the project (Lang, 1990). The highest ranked positive benefits from the development project can be seen as economic benefits (Green & Bone, 1990). The social benefits of these projects are less frequently mentioned and are ranked lower than economic benefits.

Amongst the negative effects associated with resource development, Lang, 1990 p. 133 shows the most commonly ranked item as "the need for more jobs and training". The second ranked item was "too much traffic and noise, followed by "not enough business" (item 3), too much alcohol and drugs" (item 4) and "too many southerns and transients" and "other negative effects" (items 4&5) were closely ranked (Lang, 1990 p.133). In contrast to the positive effects, the most commonly mentioned negative impacts are social ones (Green & Bone, 1990). This can be noted as a "dichotomy" of positive economic benefits at the price of social impact (Lang, 1990, p. 134). The final report on the analysis of rankings of pipeline project impacts by residents show that social problems were the most often cited negative project impact.

Case Study Four
Voisey's Bay, Newfoundland and Labrador (1996)

"The Provincial Geologists Medal is awarded to recognize major scientific contributions by Canada's provincial and territorial Geological Surveys. Each survey may nominate a candidate each year. The winner of the inaugural Provincial Geologists Medal was A. Bruce Ryan of the Geological Survey of Newfoundland and Labrador. Bruce's landmark 1990 geological map of the Nain region, together with remarkably prescient model for the origin of the Voisey's Bay nickel-copper-cobalt deposit, formed the foundation for the exploration rush that followed the discovery" (Goldie, 2005, p. 12). Labrador's landscape consists of flat, timbered land, steep-sided and flat topped hills, mazes of steep cliffs, fjords, and forested valley bottoms (Goldie, 2005). In 1970, there was the discovery of three large mafic intrusions in eastern Labrador: Kiglapait, Harp Lake, and Michikamau (Goldie, 2005). Then development planning started. All three sites were similar in shape and the same kind of rock as the Bushveld (Goldie, 2005)

The Kiglapait intrusion was the most northerly site, and the smallest, having a surface area of about 500 square kilometers (Goldie, 2005). Mineralization found at this site consisted of copper and nickel with no precious metals, across an area where no one had ever before found copper-nickle mineralization (Goldie, 2005). The Harp Lake mafic intrusion covered an area twenty times larger than Kiglapait, located about 150 kilometers south of Nain (Goldie, 2005). There were thirteen mineralized zones identified in Harp Lake (Goldie, 2005). Labrador's native groups had to negotiate "impact benefit agreements" with Inco, and at the same time they were also negotiating land claims with the federal and provincial governments (Goldie, 2005, p. 181).

While the Labrador Inuit Association (L.I.A) and Innu Nation "drove down the potholed and poorly marked roads that led to land claims deals, many aboriginal felt that they had been left behind" (Goldie, 2005, p. 184). While the provincial government and the L.I.A. were negotiating the selection of land to be included in a "final" agreement, the province "despaired to reach a deal with the Innu Nation" (Goldie, 2005, p. 186), turned the problems to the attention of the Federal Government (Goldie, 2005, p. 184). In 2000, at the end of Brian Tobin's term acting as Premier of Newfoundland and Labrador, the Labrador Metis and the Inuit and Innu of the portion of Quebec adjacent to Labrador

all believed that "the government of Newfoundland and Labrador had unfairly denied their land claims in Labrador (Goldie, 2005, p. 184).

Case Study Five
James Bay, Quebec (1994)

In Aboriginal communities, environmental and resource issues are of "paramount concern" because hunting, trapping, and fishing still play important roles in community life (VanNijnatten & Boardman, 2002, p. 93). "To assume that First Nations are politically active in environmental and resource policy solely for the purpose of controlling natural resources and extracting resource rents for their communities would be wrong" (VanNijnatten & Boardman, 2002, p. 93).

In 1971, the Quebec government announced a massive, multi-billion-dollar hydroelectric project on the river drainage system of James Bay, located in northern Quebec (VanNijnatten & Boardman, 2002). Despite efforts by citizens of eight local communities, the first stage of the project was developed by the early 1980s and the "Great Whale project" (James Bay 2) was to continue development in 1991 (VanNijnatten & Boardman, 2002). This project was enormous; it would flood an area of 3,400 square kilometers and divert five major rivers and it would also produce 3,212 megawatts of power and create 66,700 direct and indirect jobs (VanNijnatten & Boardman, 2002).

"Natural resource development can have devastating effects on Aboriginal subsistence economies" (VanNijnatten & Boardman, 2002, p. 93). One environmental effect caused by this project was due to the need to maintain adequate generation of power. This required the reversal of the river's natural cycle of high and low water levels, resulting in the drowning of 10,000 caribou. (VanNijnatten & Boardman, 2002). In efforts to protect their lands from the encroachment or expansion of resource development, locals formed a Cree with the Inuit population in northern Quebec (VanNijnatten & Boardman, 2002). The Cree bands worked together to challenge the provincial government about decisions concerning the project development. Significant strides in mitigating its effects and shaping future development were made by the Cree at this time.

Although stopping the second stage of development was a success, "the social impact of the initial hydroelectric development is hard to underestimate" (VanNijnatten & Boardman, 2002, p. 94). The flooding caused by the dams forever submerged traditional hunting and trapping grounds and also increased levels of methyl mercury in fish, an important staple of the Cree diet (Poelzer, 2002). The communities faced major social dislocation, which caused widespread social and environmental impacts of the James Bay project (VanNijnatten & Boardman, 2002). On November 18, 1994, Quebec Premier Jacques Parizeau announced that the $13.3 billion Great Whale hydroelectric project was postponed indefinitely (VanNijnatten & Boardman, 2002).

This case clearly demonstrates the role of First Nations and how they can play in environmental and resource policy communities. "The authoritative and fiscal resources that First Nations state actors are able to deploy to organize campaigns and build alliances with societal actors domestically and abroad can prove to be decisive in shaping policy outcomes" (VanNijnatten & Boardman, 2002, p. 97).

The case studies provided show how development and production has continued to increase at the expense of many social impacts to local people. It also shows show that similar social effects from large scale development can be seen across the northern part of the country. The well-being of indigenous communities should be seen as important as any other Canadian community. Increase in violence, drugs and alcohol abuse may be seen as important factors contributing to a much lower index of community well-being. Case studies show that information about social impacts have been limited and efforts to correctly identify target problems have been limited.

Discussion

Sustainability Return on Investment

Increased awareness of the impacts associated with large scale natural resource development by the general public has lead to changes in responsibility for project impacts. Today, corporations and institutions are responsible for both the environmental and societal impacts of their decisions. Therefore, it is important to determine whether there is business justification for initiatives that do not show a positive return on investment (ROI), based on traditional costing methods (Earthshift Inc., 2011-2012). Sustainability Return on Investment (S-ROI) , is a decision-making methodology that incorporates "the triple bottom line" of broad social, economic and environmental forecasting to help corporations minimize cost and maximize ROI (Earthshift Inc., 2011-2012). The S-ROI methodology is designed to use multiple viewpoints from expert stakeholders and examine a decision-making process, while maximizing ROI for as many stakeholders as possible. This is done by the ability of S-ROI to integrate measurements of the social, economic and environmental returns on sustainability initiatives (Earthshift, 2011-2012).

Total Cost Assessment (TCA) is a methodology that has the ability to include both internal costs (borne by the company), and external cost (borne by society),when calculating return on sustainability-related investments (Earthshift, 2011-2012). This allows for the enumeration of uncertain events with their concurrent costs and benefits and provides two future financial pictures of a decision obtained by the decision-maker.(Earthshift, 2011-2012). The output of TCA also provides a best case scenario and a worst case scenario and also the most probable ranges of ROI. This gives decision-makers the information they need to justify various forms of investment in socially and environmentally responsible activity to avoid trading one harmful impact for another, known as "burden shifting" (Earthshift, 2011-2012).

Traditional Knowledge:

"Indigenous societies around the world, for the most part, demonstrate a distinct lack of enthusiasm for the experience of schooling in its conventional form" (Kawagley & Barnhardi, n.d. p.117). This attributes to "an alien school culture, rather than any lack of innate intelligence, ingenuity, or problem-solving skills" on the part of the local students (Kawagley & Barnhardi, n.d. p. 117). For example, Native people have their own way of looking at and relating to the world, the universe, and each other (Kawagley & Barnhardi, p.117). "Native traditional educational approaches were carefully constructed around observing natural processes, adapting modes of survival, obtaining sustenance from the plant and animal world, and using natural materials to make their tools and implements" (Kawagley & Barnhardi, p. 117). Native education systems differ from the formal western classroom because their teachings are through story and demonstration (Kawagley & Barnhardi). Indigenous views of the world and approaches to education in the past, were in jeopardy, due to the spreading of Western structures and institutionalized forms of cultural transmission

(Kawagley & Barnhardi). More recently, however, non-native groups of people are recognizing the limitations of this "Western" educational system, and new approaches are currently being developed (Kawagley & Barnhardi).

Two-Eyed Seeing: Integrative Science:

For this research paper, I will present a new possible approach that may be used in developing a new education system. This approach uses integration, to combine the knowledge of the Western world, as well as, the knowledge of indigenous peoples. This approach is known as "Two-eyed seeing: integrative science" (Knapp, 2009, p.36), and may be defined as:

> "bringing together of Indigenous and Western knowledge.. to see from one eye with the strengths of Indigenous ways of knowing, and from the other eye with the strengths of Western ways of knowing, and to use both of these eyes together" (Knapp, 2009, p. 36).

The idea behind "two-eyed seeing" is that the strengths from both worlds, each represented by an "eye", can be brought together as one force of power, and used like a set of "eyes". I will present this approach as the ideal approach for the future of our education system. To better our knowledge of our local surroundings, the value of our environment and how to properly use the resources provided to us by mother nature need to be considered.

The "moderate" solution to social problems, given the political realities of Labrador, is through a shift to policies geared specifically toward reversing underdevelopment in a reformist manner, rather than through some sort of messianic revolution (House, 1982). Sustainable development tries to find a balance between being able to create jobs and improve the standard of living, while at the same time protecting the wildlife and habitat, air, and water that are essential to the northern way of life (Natural Resource Canada, 2003). Most importantly, it means making sure that in meeting our economic, environmental and social needs today, we do not compromise the ability of our children, and their children to meet their future needs (Natural Resource Canada, 2003). In 1992, the Rio Declaration suggested that sustainable development is about balancing three dimensions: social development, economic growth and environmental protection and achieving some kind of trade-off among them (House, 1982). Sustainable mining is classified as a non-renewable resource. In the past, sustainable mineral industry referred to an enterprise that was able to sustain itself indefinitely into the future and has grown by encompassing environmental principles as well (Lucas, Lloyde & Allen, 2010).

Integrated Resource Management:

Integrated Resource Management may be defined to provide common procedural principles: "Although the choice of specific descriptors will vary, the usual idea associated with IRM is sharing and coordination of the values and inputs of a broad range of agencies, publics and other interests when designing and implementing policies, programs or projects" (Slocombe & Hanna, 2014, p. 10). IRM is supported by many different approaches and streams of thought from conservation and multiple use to ecosystem approaches, adaptive management, and participatory approaches (Slocombe & Hanna, 2014). Integrated Resource Management is often discussed as a component of resource and environmental management (REM). It is rarely addressed systematically and hardly ever the primary focus of management (Slocombe & Hanna, 2014).

In relation to large-scale development in Northern Canada, I feel integrating interests, governments and agencies, disciplines, dimensions of sustainability and most importantly perceptions, attitudes and values (PAV) may be best. As PAV is the main component to be integrated, it is important to understand that differences found in PAVs can affect interpretations of information, goals and objectives, and history. Recognizing and seeking to work with PAVs is a big part for more participatory management at local levels and more formal conflict resolution and negotiation approaches at higher levels. Under any defining label, integration is a process of increasing organization and order in a

decision-making system and across interests (Slocombe & Hanna, 2014).

Conclusion

Currently, Canada's natural resource extraction efforts continue to increase as population and demand steadily rises. Many of the resource projects being developed are near indigenous communities in Northern Canada and have a number of common negative social impacts, such as violence, suicide, drug and alcohol abuse, as can be seen in the case studies. Social impacts felt in these communities are much higher due to the sensitivity of the culture in relation to the environment. Action by government has been insignificant, inaccurate and misleading. Literature focusing on social impacts is scarce and past studies and surveys fail to properly identify and assess the main causes and impacts of large-scale natural resource development. Literature assessing these situations in first nations or indigenous communities is even more scarce, despite the obvious need to do so.

Although development will continue in Northern Canada, measures to mitigate the social impacts on local communities near development sites need to be taken. Local people need to be both aware and involved in preparing and operating project sites. Local values and beliefs need to be considered instead of ignored and an approach to raise the community well-being of indigenous communities should be developed. Using the Sustainability Return on Investment (S-ROI) methodology, gives large corporations the incentive to make necessary changes. Traditional knowledge about our natural world in our educational system, how to relate and interact with and respect our environment by indigenous people, by using two-eyed seeing approach, could very much benefit humanity, with relation to natural resource extraction.

Finally, using an integrative resource management approach correctly can help overall to educate, increase awareness and provide mitigation strategies for social impacts due to large-scale natural resource development.

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Green Revolving Funds and the Path to Sustainability for Grenfell Campus, Memorial University of Newfoundland

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Abstract

The word "sustainability" cannot be found in the Merriam-Webster nor Random House dictionaries. Sustainable Development as defined by the Bruntland Commission "meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations,1987). Institutions of higher education are forging ahead and making their own definition of what Sustainability in Higher Education means by incorporating sustainable values into their curriculum, research and daily operations. However, given their influence and prestige, are Universities doing enough? This paper examines Green Revolving Funds, a method of investment that has proven very successful to advance sustainability in higher education. It is proposed that Grenfell Campus, Memorial University of Newfoundland, actively pursue establishing a Green Revolving Fund.

1.0 Introduction

"I propose that knowledge carries with it the responsibility to see that it is well used in the world."– David Orr, *Earth in Mind: On Education, Environment and the Human Prospect.* 1994 pg 13

The dialogue surrounding climate change has evolved from debating if it is occurring or not – and if it is, is it anthropogenic - to a point it is academically and scientifically accepted that our climate is changing at a rate faster than at any point in known history. The most recent report from the Intergovernmental Panel on Climate Change (IPCC) released in 2013 is authored by 72 experts from a wide variety of fields and nations. The IPCC report defines the current state of warming as unequivocal and unprecedented (IPCC, 2013). More certain language could not possibly be used.

The IPCC report also states that greenhouse gasses are currently at the highest level they have ever reached in the past 800 0000 years. While the most drastic of the runaway greenhouse scenarios where global climate is roughly equal to the super heated Venus proposed by earlier climate scientists such as Ingersoll (1969) is now deemed almost impossible (Goldblatt and Watson, 2012), it is necessary to leave nearly all the currently known reserves of fossil fuels in the ground or risk making much of the planer uninhabitable to humans (Hansen et al, 2013).

Clearly, drastic action needs to be taken at an international scale. However, this does not mean that in the absence of such action smaller more localized alternatives should not be acted upon. The experts that have identified the problems of climate change were able to do so due to the training and support they received through their respective universities.

Unfortunately, too often these very institutes of higher learning have not excelled in leading by example to actually reduce their impact on the environment (Bekessy, Samson and Clarkson 2007). On the other hand, Sustainability in Higher Education (SHE) is a growing trend and many universities have made significant improvements towards sustainability (See Reagan,

2012; and Blakelock, 2013 for a broader overview of SHE). Sustainability in Higher Education is a very broad topic with no precise definition, but it can be likened to the triple bottom line concept in the business world which aims to find a balance between economic, environmental and social values. In Higher education this means incorporating these principles in curriculum, research, and daily operations. Most of the leading institutions in SHE have signed declarations or incorporated sustainability directly into their mandate such as Memorial University of Newfoundland's Sustainability declaration (MUN Sustainability Office, 2009)

Recognizing that Universities *could* do more leads to the question of *if* they should do more. Throughout history people from all walks of life have spoken and written about the purpose of a university education. All have had distinct views, but similarity can be found among them in regards to social responsibility. Most philosophers from ancient times to modern day seem to agree that while the individual seeks education for their own personal benefit, the aim of the institution is to make that individual a greater benefit to society as a whole (Reed and Johnson, 1996). The pragmatist John Dewey (1938) concluded that schools must give purpose to students, and that purpose should stem from the ability to foresee future long term consequences of immediate term actions. According to Dewey, an effective institution therefore encourages students to resist impulse and desire, avoid making the easiest decision option and take care to keep things at least as good in the future as they are today.

Leading academics in SHE argue that universities have a responsibility to advance sustainability, not just an opportunity. They believe that Universities should apply to themselves as an institution the same values which they strive to instill in their students (Beringer, 2006; Uhl & Anderson, 2001; Mcgonigle & Stark, 2006; Rappaport & Creighton, 2007). Meanwhile, the duplicitous nature of universities makes unanimous agreement on what to do very difficult. (Blewitt and Cullingford, 2004). Institutions are often so occupied with updating programs and turning a profit in an effort to "keep up with the Jones'" that they no longer have any time to prioritize values based education. In order for an institution to become sustainable, a common ground must be found among all this (Blewitt and Cullingford, 2004). Successful incorporation of SHE principles will help combat this recent trend.

Across North America, Universities have discovered that Green Revolving Funds (GRF's) are an effective way to satisfy all of the conflicting interests between student attraction and retention, sound fiscal policy, prestige promotion, and social responsibility. Green Revolving funds generate a return on investment that is significantly higher than the stock market returns which university endowments are invested in. According to Indvik, Foley and Orlowski of the Sustainable Endowments Institute (2013) GRF's generate a median 28% ROI and have an average repayment period of 3.8 years. Comparing this to the average annualized ROI of 11.8% Universities see on the stock market (Barber and Wang, 2013) it is evident that GRF are a sound economic investment. It is also noteworthy that typical investments are subject to market fluctuations. Barber and Wang (2013) indicate more specifically that between 2008-2011 the annualized ROI from the stock market fell to -3.8%.

This paper will draw from existing Grenfell specific research and compare our current state with case studies of institutions with successful GRF programs. Through these methods this paper will make the case that Grenfell Campus currently has a high level of support for sustainability initiatives, but the lack of clear policies and goals combined with no dedicated funding or staff person has resulted in only minimal gains in GHG reduction. Establishing a Green Revolving Fund would not only allow Grenfell Campus to become a leader in

sustainability and work toward the culmination of the 2009 MUN Sustainability Declaration, but also be a prudent economical decision.

2.0 Research Question

This paper aims to answer three major questions about the role Grenfell Campus, Memorial University of Newfoundland, referred to herein as Grenfell, plays in the broader context of SHE and how that can be improved upon. With well established environmental degree programs which require a major independent research project to graduate, there has already been work done which discusses the merits of action at the local level, has identified opportunities for improvement which can be implemented, and established current levels of sustainability on campus.

This paper is not concerned with starting over and making the same arguments that others have already made satisfactorily in regards to the need for universities to be a driving force of climate change action. For a more full discussion on this ideology, readers are asked to see Reagan, 2012; Uhl and Anderson, 2001; Pottle and Reagan, 2012; Orr, 1991; and Mcgonigle and Stark, 2006. These papers and the sources within them do an excellent job of summarizing the need for universities to be leaders in sustainability.

The three questions this paper asks are therefore very specific to Grenfell Campus. Firstly, how does Grenfell compare to other universities in regards to sustainable environmental performance? Secondly, what barriers have prevented Grenfell from performing better than it currently is? Lastly, based on literature review and case studies, is there one major thing that could be changed in order to overcome the barriers discovered in question two?

3.0 Research Methodology

3.1 Student independent project review

As mentioned above, Grenfell Campus's environmental programs have created a respectable anthology of research. Student projects dating back to 2001 are available at the Ferris Hodgett Library on permanent reserve. To develop an idea for this independent project these projects were reviewed. Most notably, Reagan, 2012; Lam, 2012 and Blakelock 2013 were identified as having a close relationship with each other. All three projects focused on Grenfell specifically, and proposed "low hanging fruit" solutions which could tangibly reduce Grenfell's carbon footprint. One project (Lam, 2012), which proposed the transition to compostable only cutlery in the food court, was implemented in January 2014.

The other ideas in these projects are sound, but have not been implemented. Finding out why they have not been implemented and how they could be was a large part of the project motivation and two of the three research questions.

Other student Independent research on the merit and completion of environmental audits was imperative in evaluating the current progress level of Grenfell Campus on sustainability initiatives (Andrews, Boyd and Pardy, 2002; Bouzane, 2002).

3.2 Literature review

Review of the Grenfell independent projects prompted a literature review of sustainability in higher education. This review revealed the idea of Green Revolving Funds. The literature review

mainly focused on the function and implementation of Green Revolving Funds as well as factors which act as barriers to sustainability.

3.3 Case study analysis

The Sustainable Endowments Institute (SEI) tracks all known GRF's in North America. The literature review often focused on large, prestigious and wealthy institutions such as Harvard with Endowments so large it would be unreasonable to compare them to Memorial University as a whole, let alone the much smaller Grenfell Campus. The SEI database was searched to find examples which are directly comparable to Grenfell Campus. Case studies looked at included Whitman College in Washington and St Johns College in Minnesota. Both institutions are similar in size to Grenfell and the GRF initial investment is within a reasonable target. The case studies are not discussed separately, but their lessons have been incorporated into the paper throughout.

3.4 Interviews

In order to ascertain accurate information it was necessary to discuss aspects of the paper with Staff, Faculty Members and Students at Grenfell Campus who have been directly involved in some way with sustainability. Interviews were conducted with Facilities Management to clarify energy usage and measuring techniques. Dr Bob Scott and Dr Edwin Bezzina have been involved with sustainability initiatives as faculty and provided insight about their efforts. Staff members with the MUN Sustainability Office talked about university wide initiatives. Student housing Residence and Chalet Advisors helped estimate housing power usage, and current and past members of the Grenfell Campus Student Union shared their experience with student led initiatives.

3.5 Survey

The literature review revealed that one possible way to obtain seed funding for a GRF is a levy on staff and faculty (SEI, 2012). It also showed that support within the institution is essential for both the establishment and continued success of GRF's (Indvik, Foley, and Orlowski, 2013; Wright, 2009; Sorrel et al., 2004). Blakelock (2013) surveyed Grenfell students to both gauge support for a sustainability fund of some kind and willingness to contribute to such a fund. In order to more accurately assess institutional support, this survey was modified and expanded to Staff and Faculty using wording as close to the original survey as possible for comparison purposes.

3.6 Calculations

Based largely on the author's institutional knowledge as well as the work of Blakelock (2013), opportunities were identified which would make a significant difference while being easy to change. Using approximations for potential savings and estimations for institutional usage by sector the savings from initiatives were converted to a percentage of overall energy usage. This amount was then deducted from Grenfell power usage based on a monthly average. The energy was transferred into monetary savings using current rates, and then all savings were added up to present a feasible path forward. This method will be discussed in depth in the appropriate section. It should be noted that these amounts are rough estimations only, based on the best information available to the author at the time of writing. There is significant margin for error in these calculations. They should be considered accurate to a degree which encourages investment,

but due diligence to confirm their accuracy would be necessary before actually implementing the proposed cost saving measures.

4.0 Background

4.1 Overview

Grenfell Campus has three undergraduate environmental programs: Environmental Studies, Environmental Science and Sustainable Resource Management and has recently added a Graduate program in Environmental Policy. An honours option is available through Environmental Science (Grenfell Campus, 2014).

With all of this environmental focus concentrated on a small campus, it seems natural that Grenfell would be champions of Sustainability in Higher Education. While there are some environmental initiatives underway which will be discussed in section 4.3 below, Grenfell is far from the top in rankings. Out of 18 Atlantic Canadian Universities surveyed in 2008 Grenfell places among the bottom of the pack at spot 11 scoring 22% (Beringer et al, 2008). In spite of the low overall ranking, student involvement and environmental curriculum were among the best (Beringer et al, 2008). A 22% ranking is not very impressive, but Sustainability in Higher Education in general has a lot of room for improvement. The scale was developed by Mcintosh et al. (2001) and assigns a c- to this grade of 22%. The letter grade is in relation to the best scoring universities instead of overall performance. Grenfell has made some significant improvements since 2008, some of which will be discussed in section 4.3. This doesn't necessarily mean that Grenfell has improved its overall ranking when compared to other institutions - which have also presumably been improving.

Memorial University has created a sustainability declaration which was signed in 2009 by then president pro tempore Dr. Chris Loomis and accepted by all University governing bodies (Memorial University of Newfoundland, 2009). One of the four mandate points within the declaration is to measure and assess the universities environmental impacts and develop strategies to reduce them. No reduction targets are stated within the declaration, or in any other document found during research for this paper. Grenfell does not have its own unique declaration, but as a part of Memorial University and the same governing bodies which accepted the declaration, this document also applies to Grenfell operations.

Memorial University has a Sustainability Office which has a university wide Sustainability Committee. The Sustainability Office does not have a specific mandate, nor does it have any official direction to accommodate Grenfell specifically with its initiatives (Rowe, 2014). The Sustainability Committee is currently in the process of redefining its mandate and membership composition and has not made any minutes publically available since 2011 (MUN Sustainability office, 2011; Rowe, 2014).

It is a requirement for students enrolled in the Environmental programs to complete a senior level independent research project. A huge variety of topics have been covered over the years, but several projects look at Grenfell Campus specifically. A selection of these is discussed immediately below in section 4.2.

4.2 Grenfell Specific Research

Two of the first independent projects to be completed from the Environmental Studies program dealt with the idea of environmental audits. Andrews, Boyd and Pardy (2002) did a project

which discussed the merit of environmental audits. It was suggested that in order to improve the carbon footprint of Grenfell Campus, the first thing that needed to be done was to create an audit which could help identify areas with the most inefficiencies (Andrews, Boyd and Pardy, 2002).

Fitting in nicely with this project, Jennifer Bouzane completed a project in which methods of conducting such an audit as discussed by Andrews, Boyd and Pardy (2002) could be completed. Although an audit was not actually conducted at this time, a basic guide was developed which detailed exactly how to obtain the information needed to conduct an audit (Bouzane, 2002). Bouzane stated that such an audit should be completed on a regular basis and could be done by a senior level class as part of their course work.

In 2003 an environmental audit was conducted by one of the authors (Deidre Andrews) of the independent project proposing that such an audit be completed the year before. The audit looked at every sector of Grenfell, stated any risks or impacts, and proposed recommendations for staff, faculty, administration, and students to take that could help minimize these impacts for each sector (Andrews, 2003). The audit determined that the environmental performance of Grenfell was not satisfactory. Andrews believed that in order for significant change to occur the recommendations would have to be followed up on. Andrews was also concerned about environmental accountability. She believed that an attitude change needed to occur, and in order for this to happen all members of the university community needed to be aware of any research or actions on sustainability.

" It is extremely important that this document not be shelved, but rather the recommendations outlined for each area seriously considered and action taken in order to improve environmental commitment and responsibility of the college" – Deidre Andrews (2003), Pg 7 *Sir Wilfred Grenfell College Environmental Audit.*

The only copy of the audit that could be found was in hardcopy on a bookshelf at the sustainability office in St Johns. To obtain it, a copy had to be manually scanned by an intern and sent over email. After much discussion with key players involved in implementing initiatives at Grenfell combined with personal experience, any recommendations found within the audit that may have been implemented since its completion would seem to be purely coincidental, and not as part of an effort to realize the recommendations within the document.

Between 2003 and 2012 much of the research was looking at issues external to the university community. The Environmental Policy Unit (EPI) was established in 2011 and was primarily concerned with creating a master's program (EPI, n.d.). In 2012 they changed their focus more to research and completed a Carbon Footprint analysis of Grenfell Campus. This project was similar in nature to the 2003 audit. The Carbon Footprint gathered empirical measurable data on the whole campus and inputted this into sophisticated software which calculated the total amount of Greenhouse Gases being produced (Pottle and Reagan, 2012). Similarly to the 2003 audit, the Carbon Footprint project explained very clearly how to conduct the audit in subsequent years and strongly recommended that it be updated on a regular basis (Pottle and Reagan, 2012).

In a pattern similar to 2002, 2012 also saw a student independent study on why carbon inventories need to be created and how to complete them. This project, released at about the same time as the Carbon Inventory made a strong case for why universities need to be leaders in sustainability (Reagan, 2012). Reagan also proposed a path forward with a step by step proposal involving a sustainability coordinator and further audits.

The series of audits discussed above from 2002-2012 paint a picture of Grenfell Campus which leaves much to be desired on the environmental front. Not all research has focused entirely on what is being done wrong or not done at all. Two projects in particular from Sustainable Resource Management graduates Kevin Lam and Paul Blakelock present a number of opportunities to do better.

Lam collected data on cutlery usage in the food court and determined that a large amount of waste resulted. Solid waste is responsible for roughly 70% of Grenfell's total GHG emissions (Pottle and Reagan, 2012). Research suggested that the marginal price increase to transition to compostable cutlery would not be significant, and should be pursued (Lam, 2012). Compostable cutlery became policy in January 2014 and is discussed below in section 4.3. Lam's work showed that bottom up initiatives can come to fruition given the right circumstances.

Paul Blakelock looked at the current state of sustainability initiatives at Grenfell and determined that many easy to fix measures such as repositioning of recycling, installing vending misers, improving composting and enforcing light policies. To name a few, could be implemented that would make a significant difference combined. Most of these initiatives involved an upfront cost although not large. The best method to pay for this cost according to Blakelock (2013) would be to implement a fee on students. The suggested fee had overwhelming support from the student body (Blakelock, 2013). The "low hanging fruit" opportunities proposed by Blakelock provided significant guidance for this paper.

4.3 Current Environmental Initiatives at Grenfell

4.3.1 Composting

Grenfell Campus acquired and launched an industrial composter in 2012 (Grenfell Campus, Memorial University of Newfoundland, 2012). The composter has successfully diverted large quantities of organic waste that was previously going straight into dumpsters. As of February 2014, nearly 50 tonnes of waste has been processed (Kennedy, 2014).

Lam (2012) proposed changing all disposable cutlery that food is served on to compostable materials. In January 2014 after long discussions, a clause came into effect that had been written into contracts between vendors and the the Grenfell Campus Student Union (GCSU) which stipulated all food and beverages must be sold on approved compostable materials. This change carried no additional cost to any party and was planned to go hand in hand with a bottled water ban (Wiseman, 2013).

4.3.2 Bottled water

Following a petition organized by the GCSU a voluntary ban on the "the elimination of the purchase of bottled water anywhere on campus including through vending machines and at our catering establishments" (Bluechardt, campus wide memo, 2012) was announced by senior administration. The GCSU disallowed food court vendors from selling bottled water and partnered with administration to eliminate the product from vending machines. Administration and GCSU also partnered to promote the refill stations on campus and ensure that they remain in good repair (Wiseman, 2013).

4.3.3 Campus garden

Ten plots and a small shed with rainwater collection exist in the Campus Garden located by the Forestry Center. The garden was an initiative of the now defunct Garden Committee which recruited volunteers and fundraised to make the garden a reality. In the first couple years the garden struggled with lack of water access and poor soil conditions. The location of the Garden will have to move due to a monument scheduled to be constructed at the current site. There are no definite plans in place for the future site to date (Wiseman, 2013). While yielding a small harvest for plot operators, the garden has not been able to provide any food to the broader campus community yet.

4.3.4 Hazardous waste collection

The GCSU collects batteries, cell phones and some other types of hazardous waste. The materials are stored safely in a maintenance shed until they can be disposed of properly (Keeling, 2014).

4.3.5 Environmental organizations

The Environmental Affairs Committee (EAC) of the Grenfell Campus Student Union has been active since 2001 and is most certainly a major contributor to the Campus' high student involvement ranking by Beringer (2008). The EAC has held a wide variety of events over the years including funding research, organizing campaigns, hosting forums and most recently serving up a bi-weekly "farmers feast" that provides free organic locally produced meals to the campus community (Mercer, 2014). The EAC is one of the reasons that Grenfell scores highly in student involvement categories.

The Vice President's Advisory Committee on Sustainability reports directly to the Vice President and was responsible for implementing the composting program as well as some other projects such as paper recycling (Scott, 2014).

4.3.6 Buildings

New buildings which have been constructed or are under construction have energy conservation features installed such as high efficiency motion sensor lighting. Contrary to popular belief and hopes while under construction, the Arts and Science extension is not a LEED certified building but does outperform other university buildings in terms of energy usage (Hulan, 2014).

5.0 Barriers to Sustainability in Higher Education

It is clear from the evidence presented above that despite some positive recent developments; Grenfell Campus could be doing much better. What is also clear is that various groups have identified and attempted to fix some of these problems with limited and varying degrees of success. With very good quality research on the topic such as Blakelock (2013), it is not immediately clear why Grenfell is not in a much better state. In order to advance sustainability and determine a path forward it is necessary to understand why more progress has not been made.

There are four main reasons that universities struggle to move more quickly toward sustainability (Wright, 2009; Sorrell et al, 2004; Maiorano, 2012; Schleich, 2009)

1. Financial constraints and hidden costs
2. Bounded Rationality
3. Imperfect Information
4. Turnover and split responsibility of champions

By understanding these four barriers it should be possible to come up with a solution. A barrier is defined by Sorrell et al (2004) as "a mechanism that inhibits a decision or behavior that appears to be both energy efficient and economically efficient". A Green Revolving Fund should be able to overcome all of these barriers.

5.1 Financial constraints and hidden costs

In a survey of University Presidents and Vice Presidents financial constraints were identified as the number one reason that discouraged investment in sustainability (Wright, 2009). In Wright's survey (2009), senior level administrators explained that they often either do not have access to the large amounts of one time capital investment required for projects, or what money is available is already allocated to something else. Maiorano (2012) explains that hidden costs are things such as human resources expenses created by people allocating resources to different projects or the cost of gathering and analyzing data. Administrators or department heads are aware of these hidden costs, which discourage them from investing. Hidden costs, like large capital investments, show up only as an expense item during budgeting with no tangible return on the balance sheet. This makes it hard to advocate for investing even if cost savings might mean it is a prudent decision in the medium to long term (Sorrell et al, 2004).

Grenfell Campus, despite becoming more autonomous, does not have full control of its own budget. This means that in order to fund costly projects a request must be put in to Memorial University and then forwarded to Government for approval. This is a long and arduous process, and without someone in person to explain the merit of the investment it may not be approved. This is one of the many reasons a sustainability coordinator is necessary and is discussed in section 8.5.

5.2 Bounded Rationality

Bounded Rationality is a concept coined by economist Herbert Simon. Simon's theory supports the rational decision making process of humans, but discusses how the process is first simplified to the scope of our own understanding (Simon, 1991).

In other words, humans are not perfect. Decision makers are faced with many variables which can impact the way they prioritize what is important. These factors can lead to a weighting system which may in actuality not be sound. Some examples include that person not having enough influence or the person reporting to them not having enough influence, lack of technology, career aspirations, an unwillingness to assume risk, and institutional reluctance (Schleich, 2009). These factors lead to actors favouring indecision over action (Sorrell et al, 2004). "Actions and decisions require a greater justification than inaction, than failing to decide. If our actions do not pan out, or cause a loss, we regret having acted. If, instead, we do not act, if we leave things as they are, and our investment does not pan out, or we lose, we still suffer regret though the regret is lesser"(Piattelli-Palmarini, 1994, pp.27-8 – Sorrell, 81).

In a Grenfell based example, after the ban on bottled water was announced significant backlash ensued from staff, faculty, and students who were concerned about a variety of issues from water quality to availability. Trying to do the right thing and receiving negative feedback is enough to cause some people not to bother in the first place.

5.3 Imperfect Information

Much like humans are not perfectly rational, information is not always perfectly accurate. It is possible that no baseline data exists at all or that it was not collected using accurate means. Depending on the way information is gathered, sustainability could be deemed to have little impact. This is something Grenfell will struggle with, as individual electrical metering for buildings is severely limited (Hulan, 2014; Duffy, 2014). The main meter absorbs the readings from all areas of campus except for the rec plex which is metered separately (Hulan, 2014). This makes it very difficult to assess both how much energy individual departments such as housing are using as well as how successful conservation methods will be.

5.4 Turnover and split responsibility of champions

Wright (2009), Sorrel (2004) and others identify this as a minor factor, but do not rank it as very important. This could be because more of the institutions studied are rather large. Larger

institutions have longer-term staff that is responsible for overseeing projects. St Johns campus for example has the Sustainability Office. Smaller institutions like Grenfell do not have this luxury. Brinkhurst et al (2011) acknowledge that smaller institutions tend to lean towards bottom up approaches to sustainability. This means that staff faculty and students are the leaders who bring ideas forward. A champion may be a committee, and organization, or a collection of individuals. When an individual who is "championing" an initiative leaves or becomes too involved with another responsibility the whole cause may be dropped and never be picked up again. There are numerous examples of this occurring at Grenfell.

The Sustainable Endowments Institute (2012) indicates that the identified champions of GRF initiation are multi departmental 59% of the time. The other 41% of the time an individual champion is spearheading the cause. Even when multi-departmental initiations occur, one person leaving may derail the entire process or halt it from ever beginning. The high percentage of multiple stakeholder initiations indicates that this is the most successful path.

6.0 Green Revolving Funds

Many authors have written about Green Revolving Funds, but the best source is the Sustainable Endowments Institute which monitors all Green Revolving Funds in North America. Indvik Foley and Orlowski (2013) have published a guide produced by the Sustainable Endowments Institute which is the most complete document on implementing GRF's at universities. Indvik Foley and Orlowski (2013) define a GRF as "an internal fund that provides financing to parties within an organization to implement energy efficiency, renewable energy, and other sustainability projects that generate cost-savings. These savings are tracked and used to replenish the fund for the next round of green investments, thus establishing a sustainable funding cycle while cutting operating costs and reducing environmental impact".

In theory, GRF's are really quite simple. The complicated aspect is that no two GRF's will work exactly the same because of the anatomy of the institutions they are based at. Based on data from 79 GRF's at 76 institutions, the amount of money in GRF's varies from $12 000 at Bucknell University to $13 million at the University of Vermont (SEI, 2012). Of the 76 institutions the Sustainable Endowments Institute surveyed (2012), sizes varied from 192 at Burlington College full time students to 70 440 at the University of Arizona. From this it is fair to say that a GRF can work for anyone.

Green Revolving Funds have sprung up in countless different ways and no two universities will be the same. The main idea is that no matter where the funding comes from, they must be able to reduce the overall environmental impact of the institution and capture savings or revenue to be reinvested back into the fund. Any fund that does those two things – regardless of how – will qualify as a Green Revolving Fund. For the purposes of analysis, quasi revolving funds are not counted. A quasi revolving fund is when the fund is topped up regularly by a mechanism such as student fees but savings are not captured and reinvested. Funds such as these can invest in more high risk ventures, or efficiency projects which may not create savings as the intent is not to use a qausi-revolving fund to necessarily generate a return.

After a review of Green Revolving Funds and how they work, fig 6 was created to demonstrate nine steps to implement a GRF to any campus. Fig 6 is adapted from Indvik Foley and Orlowski's (2013) guide to GRF implementation. Indvik Foley and Orlowski have a 10 step model which is slightly more complicated and also has a final step of optimization. In the Nine Step Cycle proposed, optimization is placed in the center of the cycle and applied to every single step instead of at the end. One potential flaw of the Nine Step Model is that it makes an assumption that the institution has done sufficient research and already decided on a GRF model.

Fig 6.0 The Nine Step Cycle to implementing a Green Revolving Fund (Adapted from Indvik, Foley and Orlowski, 2013; SEI, 2012)

The cycle starts at the top with the fund, of which exact structure will have been decided on. The size of the fund will depend on the funding source(s). For Grenfell Campus, a starting fund of $100 000 is suggested. Section 8 will discuss methods of initial seed funding. The next step is to evaluate baseline data or if none exists, obtain baseline data. It is possible to proceed without first completing a formal energy audit because an in-house assessment may have already been done by facilities management staff. Many institutions have a list of infrastructure upgrades or deferred maintenance priorities. Memorial has an agreement with government in place to fund

deferred maintenance projects, and Grenfell Campus has items on that list (Marketing and Communications, MUN, 2012).

While it is possible to partially skip step two, it risks undermining the most successful part of a GRF which is reinvesting savings to grow the fund. Without the baseline data measurements have a lower degree of accuracy.

Identifying opportunity involves first deciding what the institution will prioritize, and the amount of money in the fund. Is the goal to make the biggest impact on emissions by tackling the largest problems? Should they easy things be selected first? Should the decisions be based on a cost to energy savings ratio? These questions have to be determined first. After the criteria are decided upon, the list will no longer be so subjective.

Making a plan and administering a plan are not the same things. Let's presume the decision is made to tackle lighting costs. A plan may be to develop a policy to replace all lights when they burn out, and ensure that non-essential lights are off at the end of the day. Putting a plan into action means that someone is actually responsible for ensuring that the outcomes are realized. Who reports a light out, and who checks to make sure that the correct replacement goes in? Who goes around turning off all of the lights? Is there a penalty for leaving lights on? If so, how is it enforced? An example of a comprehensive sustainability plan is Yale's Sustainability Strategic Plans. On an initiative of the President, a working group was formed to create the 2010-2013 Strategic Plan (Yale University, 2010). The plan set aggressive targets including 95% of all cafeteria waste be composted, all new construction achieving "at least" LEED Gold, payment for ecosystem services, and a 16% overall reduction in greenhouse gas emissions based on 2005 amounts (Yale University, 2010). In 2012, Yale achieved the targeted 16% reduction and then set about completing a new Sustainability Strategic Plan for 2013-2016 (Yale University, 2013). The Sustainability Office publishes annual progress reports which are based on the goals established in the strategic plan. Yale is an example of an institution which is doing sustainability very well. They recognize that the plan itself will not reduce emissions without taking another step to actually implement it.

It is not sufficient to just think that a difference was made without measuring. This is one of the most complicated aspects of a GRF. Measurement problems may exist for a number of reasons but a common one is due to lack of specifics in the institutions measurement techniques. This is a problem that will be faced by Grenfell Campus. Electricity readings for the whole Campus are taken through one meter with the exception of the Recplex (Pottle and Reagan, 2012; Hulan, 2014; Duffy, 2014). To calculate individual power usage by area a rough formula is used where the area being charged is converted into a percentage of the total area of all buildings on that meter. The total power usage is then divided by whatever the percentage may be, and that department or tenant is charged according that formula (Hulan, 2014). This system makes the assumption that all areas use energy equally. This is not a correct assumption. A regular chalet apartment is 1047.5 square feet. There are classrooms of similar size. Due to lack of separate meters, a classroom is assessed the same energy cost as a chalet apartment. A classroom is not generally used for a full day, and is hardly ever used between the hours of 9PM

and 8:30 AM. While a classroom is in use it has a few pot lights on and is powering one computer and one projector. Most classrooms do not have accessible outlets for students to charge their own laptops. A chalet is in use at all times to some degree. This means lights in all rooms, four people charging electronic devices, heating costs, TV's and accessories such as gaming consoles or sound systems, cooking, and showering. Although no empirical evidence exists on this issue yet, it is safe to assume that a chalet uses significantly more power than a classroom.

The result of this formula is that areas are potentially being overcharged such as office tenants while others are likely undercharged such as housing (Hulan, 2014). It also makes it nearly impossible to tell what energy is actually being used for. It is possible to overcome this problem by acquiring a portable current measuring device which could be used to get exact readings travelling over certain routes (Hulan, 2014). This process would require an additional human resources commitment but according to Hulan (2014) the cost is not prohibitive and this route could be pursued.

The University of Kings College in Halifax Nova Scotia struggled with this same problem when trying to participate in the C3 challenge which is an Atlantic Canada wide competition aimed at energy conservation and gives prizes for the residence which has the most significant reduction (Campus Climate Challenge, N.D). Kings College, like Grenfell, does not have unique metering for its buildings. Kings was unable to participate officially in the competition but tried to hold events anyway. They used a system based on estimation that is not significantly different than Grenfell's current system (Campus Climate Challenge, N.D).

The final step to GRF implementation is to capture savings and reinvest the savings back into the fund. One challenge of capturing savings is that some fluctuation may be organic (Hulan, 2014). It is entirely possible that the end result uses more energy than originally due to increased demand. When the Arts and Science Extension was brought online, the overall energy usage of Grenfell increased (Duffy, 2014). This is a bit misleading if energy measurements are the only method of determining savings. The Arts and Science extension uses less energy than a more poorly designed building of the same size would be using. One way to calculate savings in a scenario such as this is to base the savings on a forecasted maximum and minimum. To give a numerical example, if the expected minimum additional energy usage of the arts and science is 10 units, and the actual reading is 8 units than there are 2 units of savings. An actual usage reading within the maximum-minimum range could not be counted as savings. An actual usage above the range would indicate negative savings.

Often times sustainability initiatives save money but this money cannot be clearly tracked on the budget. Administrators see money going out but do not see money coming in directly so they may be discouraged from investing (Wright, 2009; Velazquez, Munguia & Sanchez, 2005). Finding a way to capture these savings can turn an expense item into a revenue item. In some cases a portion of the savings are transferred directly back to the department that enacted the change. This acts as an incentive. For example if housing finds a way to save $6000 annually on

heating, they would receive $3000 and the GRF would receive $3000. Mattheissen and Morris (2004) clarify budgeting methodology which can asses cost benefit analysis and capture savings.

Greenbillion.org in association with several other organizations has developed an online tool called GRITS, or the Green Revolving Investment Tracking System which acts as a user friendly calculator to track investment and savings as well as compare it to a network of institutions (Greenbillion, n.d). GRITS is easy to learn via a serious of online short tutorial videos.

At every stage of the cycle it is imperative that the whole process is constantly being reviewed. If necessary a step may have to be done over again, or the process may actually go backwards to fix any problems that arise.

7.0 The economic case for Green Revolving Fund creation

Green Revolving Funds are not just a way to improve overall environmental performance. GRFs typically have a very high return on investment. According to the Sustainable Endowments institute (2012) the median return on investment is 28% and the median payback period is 3.5 years. Only well established GRF reports were used due to inconsistency of more recent numbers from recently created funds. With some institutions reporting returns of 57%, projections would indicate that the 28% median ROI would increase if all GRF data were to be used. There is not much long term data available because prior to 2008 only 12 GRFs existed. In the past few years the number of institutions with GRFs has increased enormously. In just one year between 2011 and 2012 the number of institutions with enrollment under 5000 that have a GRF increased from 16 to 27. The total number of GRFs as of 2012 stands at 76 (SEI, 2012).

Institutions which responded to the SEI survey indicated that the most popular reason to create a GRF was financially motivated. Institutions needed a method of funding infrastructure improvements and were motivated to save money on utility bills to combat constantly rising electricity costs.

Unlike stock market fluctuations, investments in sustainability are safe. The cost of utilities is constantly rising, as is electricity demand. This means that institutions are guaranteed additional returns every year by sheltering against rate increases.

Studies have shown that applying principles from private business to University management results in an economic case for sustainability (Walton and Galea, 2005). In the business world achieving the largest profit margin involves lowering expenses as much as possible. Businesses like to be able to boast about socially sound policies which draw prestige and more business. A Green Revolving Fund can achieve both of these business lessons (Johnson, 2003; Hart and Ahuja, 1996).

Doing the right thing socially means doing the right thing economically.

8.0 Green Revolving Fund success checklist

Based on substantial literature review, case studies and interviews, it was determined that there are seven factors which must be present for a GRF to be successful. These seven factors differ from the implementation steps discussed in section 6. The implementation steps are actual actions which must be taken while the success checklist is more of a test to determine if the institution is suitable for a GRF. By assessing the presence of these seven factors at Grenfell we can determine if a Green Revolving fund will work.

The seven steps are adapted from the work of Wright (2009) who surveyed university presidents on sustainability and the American Association of Sustainability in Higher Education (2008) which conducted a survey of sustainability coordinators. These two studies look at both the broader topic of institutional mandate from a top-down approach and the views of the people who are responsible for actually following through with that mandate. The studies draw similar conclusions. The checklist factors that will be discussed separately below are: 1. Institutional mandate and support; 2. Support within the institution; 3. Accurate energy and GHG audits; 4. Presence of a sustainability committee; 5. Dedicated staff person; 6. Start-up capital; 7. Measurement techniques.

8.1 Institutional mandate and support

Brinkhurst et al (2011) summarize the debate on whether sustainable changes happen best at universities from administration directives or staff faculty and student initiatives. They determine numerous examples of both top down and bottom up approaches that have been seen as successful. In most examples, a combination of both approaches proved most prolific and from this it can be concluded that a combination of both approaches is also the most successful. Brinkhurst et al. (2011) note that administration has the final say in what funding gets approved; so if only one approach could be chosen, it would logically have to be the top down approach over the bottom up approach. Blakelock (2013) concluded after analyzing Grenfell's sustainability opportunities that buy in and support from senior administration would be "essential" for success.

Some Grenfell researchers have proposed that Grenfell sign a declaration such as the Talloires Declaration which commits signatories to goals and shares experiences (Pottle & Reagan, 2012; Reagan, 2012). This could not do any harm - only do further good - but Bekkessky, Samson and Clarkson (2007) along with Beringer (2009) show that the performance of sustainability at universities has absolutely no correlation to the signing of agreements or declarations. In a survey of Atlantic Canada Universities some institutions which had not signed declarations outperformed others that did (Beringer, 2009). Most leading universities have signed declarations, but the declarations themselves are not what have caused the institutions to become the best (Bekkessky, Samson & Clarkson, 2007). What these studies indicate is that a high level of administrative support is necessary, but that the support cannot necessarily be determined by solely by signed declarations, particularly if the declarations are non-binding.

Grenfell has the institutional mandate required. The President's office has shown this by signing a sustainability declaration in 2009 (MUN Sustainability office, 2009) and incorporating a section on sustainability into Memorials vision and mandate. There has been continued investment in Environmental curriculum, labs, and research (Environmental Policy Institute, n.d). At Grenfell, administration has shown support by moving forward on a bottled water ban, support of the composting program and is generally receptive to students' feedback on environmental issues.

8.2 Support within the institution

Regardless of if a top up or bottom down approach is being used, support within the institution is essential to overcome the bounded rationality barrier.

A Grenfell Sustainability Fund (GSF) was proposed by Blakelock (2013) as a follow up to the sustainable purchasing policy proposed by Reagan and Pottle (2012). Neither paper proposed a Green Revolving Fund as an alternative. Blakelock suggested what is known as a "qausi-revolving fund". Such a fund exists at the University of Vermont in addition to their more traditional GRF (Erickson, 2014). Quasi revolving funds can give funding to more creative student initiatives without being overly concerned about return. One example would be a greenhouse which provides local food for the campus but generates no measurable return. Quasi revolving funds are more typical in larger universities where a small levy results in a big sum.

Blakelock (2013) suggested that a levy be put in place on students that could top off the fund every semester. To determine the support for this he conducted a survey with a high degree of accuracy to a large sample size of 300 students. The survey showed definitive support both for more environmental initiatives and for a sustainability fund with students reporting they would be willing to contribute money. Blakelock concluded that student support levels were high for increasing sustainability at Grenfell. See figures 8.1 and 8.2 below.

Fig 8.1 Question 2

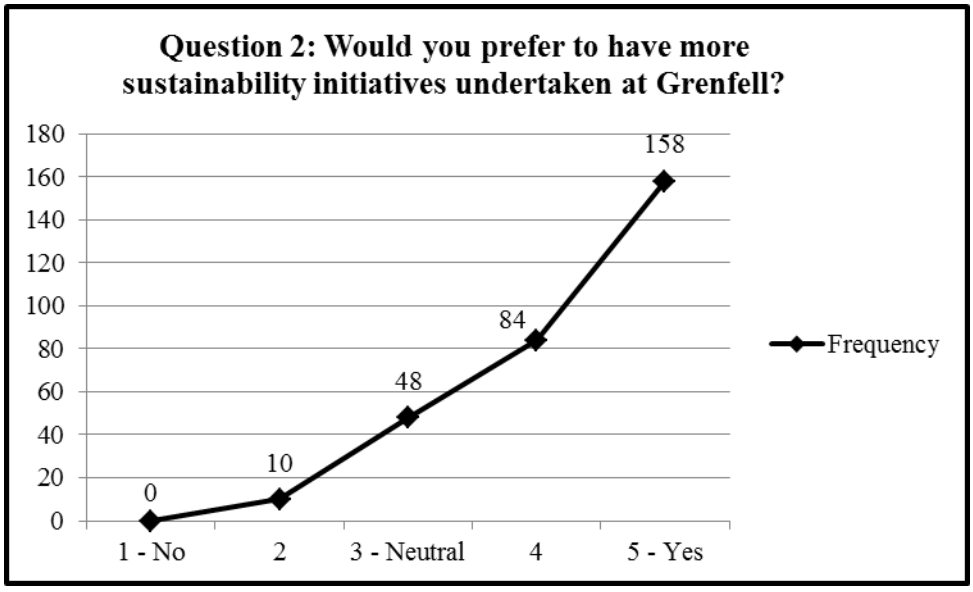
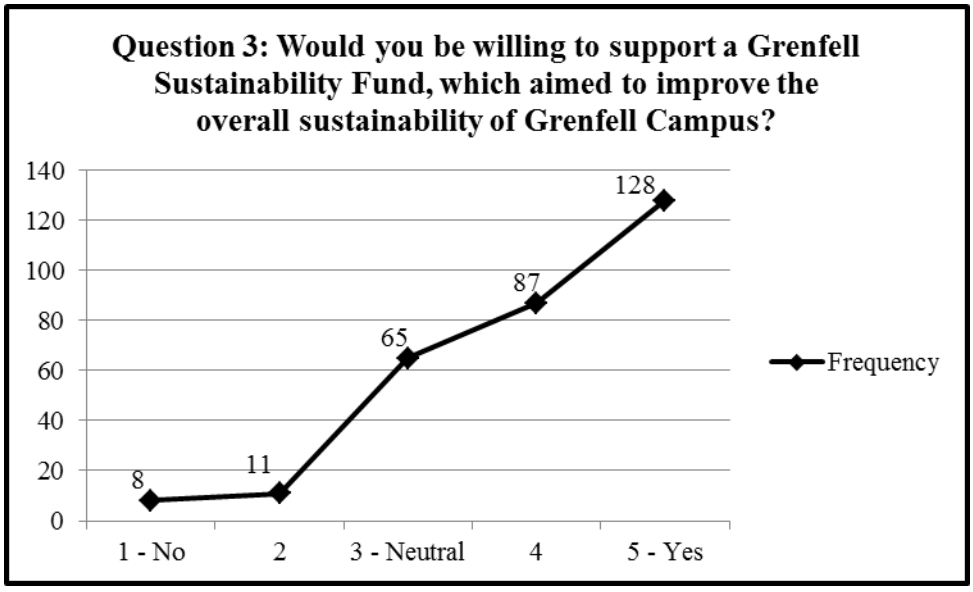


Fig 8.2 Question 3



Blakelock (2013) did not survey staff and faculty. In order to access their support, a similar survey was created with questions being worded as close as possible to the student survey. This survey had a much lower sample size of only 42, but respondents were spread quite evenly throughout all departments which is a good indication of total support based solely on environmental faculty support. Results from the staff survey were very close to results from the student survey. Only 11.9% of respondents did not want more sustainability initiatives and only 4.8% were unwilling to contribute to a fund. See figures 8.3 and 8.4 below. Values 1 and 2 represent a negative response, 3 represents neutrality and 4 and 5 represent an affirmative response.

Fig 8.3 Staff Survey "Would you prefer to have more sustainability initiatives undertaken at Grenfell?"

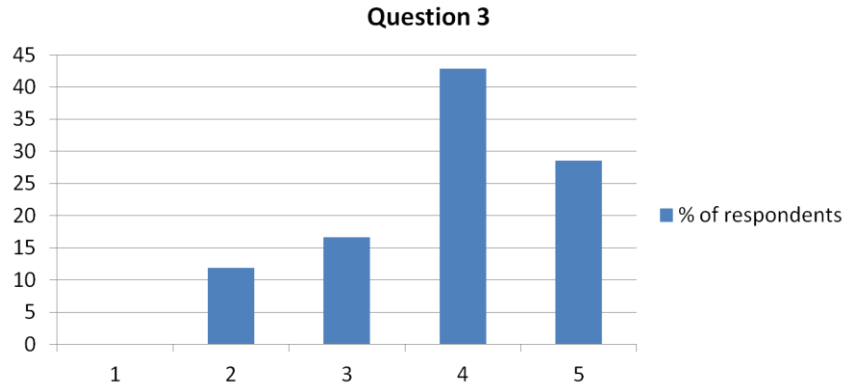
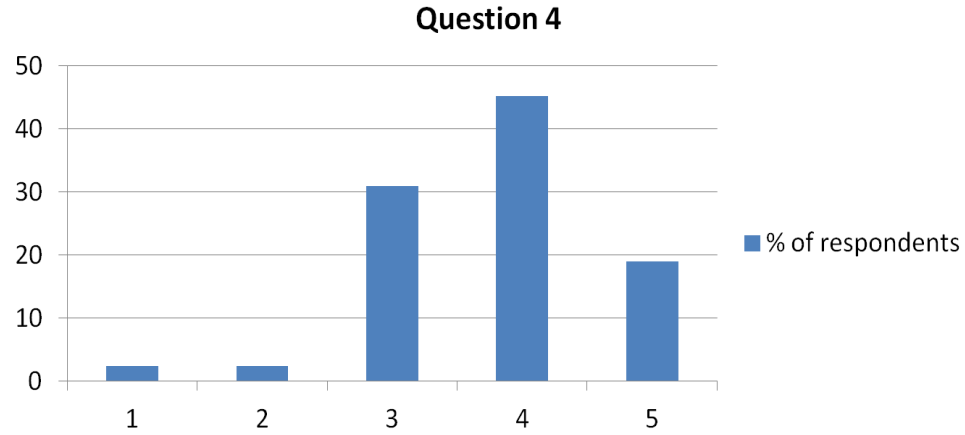


Fig 8.4 Staff Survey "Would you be willing to support a Grenfell Sustainability Fund, which aims to improve the overall sustainability of Grenfell Campus?"



Like the student survey, there was an opportunity to express thoughts on the topic in an open ended format. The majority of these comments made suggestions for new initiatives or more promotion of current initiatives. One respondent said:

"If Grenfell wants to become a more sustainable campus then they need to put the funds and resources towards it. We talk about sustainability in the strategic plan but seem to make no effort to become a more sustainable campus, to me this seems like an effort to save face. We have someone working on composting efforts and have made great strides in that area. Why not take that position and reclassify it into a Sustainability Manager position. This person can work with government along with internal and external stakeholders to make this a truly sustainable campus. It's time that we as a university start to walk the walk."

Staff showed lots of support in the open ended question allowing comment. Suggestions of what Grenfell should do varied from improving waste management which was the most popular

suggestion to ambitious projects like Green roofs or Solar Aquatic systems. The answers to this question both summarized and in full, along with the whole survey, can be found in appendix D.

It is clear from these two surveys as well as the high participation rate in the Environmental Affairs Committee that Staff Faculty and Students all desire and are willing to support directed initiatives towards a more sustainable campus.

8.3 Accurate Energy Audits

In order move forward it is important to know where you currently stand. Energy and environmental auditing at Grenfell was discussed in section 4.2. An update of the EPI audit is required due significant infrastructure changes since the audit was done. The EPI audit could be upgraded by a senior student of a part time grant intern. The full environmental audit of Andrews (2003) could be done again but would likely be more practical as part of a larger sustainable plan. Even without an update, Grenfell meets the minimum requirements of this success factor.

Several sources confirm the existence of a full energy audit that was completed by an outside source which accessed the energy performance of Grenfell and presented upgrade costs as well as potential energy savings (Hulan, 2014; Mercer, 2014; Smith, 2014; Rowe, 2014; Bezzina, 2014; Advisory Committee on Sustainability, 2009). Despite confirming in some way that work was completed on an audit - most likely completed by well known energy firm Honeywell - no sources indicated if any upgrades took place as a result and no sources were able to provide the actual audit. Minutes from the Advisory Committee on Sustainability from January 14, 2009 state: "Energy Performance Contract project is moving ahead at Grenfell. They are waiting for a report of final options and cost (approx. $5 million project) and are hoping to get approval of capital and the green light from the Board of Regents by December 2009."

There was no further mention of the audit or the $5million dollar project in Advisory Committee on Sustainability minutes. A cursory search of Board of Regents minutes also revealed no information. This audit, if it exists, should be found and re-evaluated. If it is located it should also be determined why a document funded with public money which serves to further knowledge has not been made publically available.

Regardless of the existence of any external audits, the work done internally should be sufficient to move forward and help with administration of a GRF.

8.4 Sustainability Committee

A sustainability Committee is important for a number of reasons. Primarily, someone has to be responsible for approving projects and it is best not to have one individual in charge of this. Additionally, Sustainability Committees help deal with several of the barriers to sustainability in section 5. Sustainability committees can serve as the middle ground necessary between top down and bottom up approaches (Bekkesky, Samson & Clarkson, 2007). A Sustainability committee also helps overcome imperfect information and bounded rationality by having a multidisciplinary

panel of experts. It does not fully overcome the barrier of turnover because every new committee member has to play "catch up".

A sustainability committee is by far the most popular and successful way of providing GRF oversight. According to SEI (2012) over 67% of all GRFs are facilitated by a sustainability committee. In many instances this committee existed prior to the GRF.

Grenfell already has a committee which could slide nicely into an oversight roll. The Vice President's Advisory Committee on Sustainability (VPACS) is comprised of a wide stakeholder group of staff, faculty, students and administration. VPACS has proved that it can be effective through championing the composter program. If Grenfell were to develop a GRF, this committee could handle oversight of such a fund (Scott, 2014).

The Sustainable Endowments Institute (2012) and the Association for Advancement in Sustainability in Higher Education (2013) note that in addition to a committee, the day to day operation and project management is conducted by either a much smaller working group or a project coordinator.

8.5 Sustainability coordinator

Growth in the number of Sustainability coordinators in North America mirrors growth of GRFs. According to AASHE (2013), over 90% of sustainability sector workers have held their current position for less than 5 years, and 92% of workers said they were either the first or second person to hold that position. While some sustainability offices have existed for a long time, it is no coincidence that sustainability coordinators have had a massive increase since 2008 which is just before GRFs increased 15 fold. 67% of all respondents to the 2012 survey said that their positions were created or upgraded since 2008 (AASHE, 2013). This timing clearly indicates that sustainability officers act as catalysts to make results happen and are an essential part of a successful GRF.

It is important to realize that sustainability coordinators are the lowest of a generalized three tier sustainability officer hierarchy. Sustainability coordinators would report to a sustainability manager who would report to a sustainability director or chief sustainability officer. Grenfell would not need a sustainability manager or sustainability director at this point in time. As the need grows, a new position could be created. AASHE (2008) states that the median pay for a sustainability coordinator who has an undergraduate degree working for an institution under 5000 students is $38 400. The 2012 AASHE survey does not break down salaries in the same manner. In the 2012 survey education levels and institution size is not stated in the same way and uses more generalized "across the board" data to calculate stats. According to AASHE (2012) the median pay for a sustainability coordinator would be $45 000. This figure would include coordinators that have a higher level of education than an undergraduate degree.

Grenfell currently has a position titled Administrative Program Assistant – Compost Program. The compost assistant also has a recently hired intern (Kennedy, 2014). The author is not aware of compensation to either position. It is recommended that the Compost assistant

position not be renewed to make way for a sustainability coordinator. The sustainability coordinator could oversee the compost project as one of their duties, and a grant could be obtained to hire a part time student to assist with the compost at little or no cost to the University. With Facilities Management handling the day to day of composting operations and VPACS available to provide direction and oversight, the human resources tied up in this position could be more effectively allocated to a broader role that could help catalyze more environmental initiatives and reach out to the community to further enhance Grenfell's image.

8.6 Seed Capital

The size of a fund will dictate the types of projects that the fund takes on. Generally, larger institutions have larger funds. Big funds will tackle large projects like building upgrades while smaller funds take on the "low hanging fruits". There are quite a few sources of funding which exist. The following list should not be considered exhaustive. There may be similar sources generalized into one.

External Funding/grants- MEC, banks, industry, private enterprise, Environmental-NGO's
Re-allocation of investment from stocks/mutual funds
Levy on staff/students – parking fee, per semester fee
Government commitment matching
Reallocation of general operating budget
One time influx of capital from deferred maintenance budget
Alumni and charitable donations
Administrative budgets
Cost savings of previous projects
Energy reduction incentive programs
Cash reserves

Any combination of options will work. Some larger options such as a diversion from general operating budget could finance the fund entirely. Some places have started a fund entirely on student fees. A sustainability coordinator, committee, or whoever is trying to set up a GRF first major task would be to get funding for the GRF.

Two comparatively sized universities are Whitman College and St Johns College. Whitman has a fund of $50 000 and approximately 1500 students and St Johns College has a fund of $100 000 with just under 2000 students (Kononenko, 2014).

Whitman College has had a number of successful smaller projects such as rooftop gardens spearheaded by students with a repayment rate of just 2.5 years (Kononenko, 2014). Students at Whitman may be eligible for part time paid internship positions as part of their project funding or as to help provide continuity to another project (Whitman College, n.d) but Whitman does not have enough sustainability funding for sufficient full time staff, which students cite as a

difficulty for tackling any major projects (Kononenko, 2014). The case study looked at a project costing just $600 and the difficulty of getting commitment to this low figure.

St Johns College, like many smaller campuses, has a high level of student driven projects. The case study summarized by Konoenko (2014) discusses a $40 000 hydroponics greenhouse project led by a student. The student had to consult with many different departments external to his own faculty and had trouble being taken seriously. The student received the assistance of a staff member who was willing to vouch for the student and pledge his own long term commitment to the project should the student graduate or move on. The greenhouse project went ahead and is a big success.

The difference in funding between the two similarly sized institutions made a big difference in the scale of the projects that leaders were able to work with. At Whitman the resulting garden produced a bit of food for a small amount of the student body, not unlike the campus garden at Grenfell. At St Johns College, the hydroponic greenhouse created 3 part time labourer jobs, a management position that receives course credit in lieu of pay, and generated savings on both food transportation costs and revenue on produce sale (Konoenko, 2014). Another important note is that St Johns college provided the seed capital for its GRF entirely from the general operating budget.

These two case studies combined with the extensive list of seed capital potential sources and the low hanging fruit opportunities pointed out by Lam (2012), Blakelock (2013) and discussed in section 8 are indicators of what size fund Grenfell should have. The author recommends a target of $100 000. This is a reasonable and obtainable goal while still being large enough to pay for any initial projects. If the fund proves successful the case could be made to increase the size of the fund.

7.7 Measuring systems

A Green Revolving Fund doesn't work if it is missing the revolving part. The Revolving part can't happen if money doesn't go back into the fund. The more specific savings can be measured the better because it is easier to both predict and prove returns. Grenfell will have trouble measuring savings due to our limited metering capabilities (Hulan, 2014). Metering is not the only problem. Larger institutions have a hard time calculating savings because of the high number of variables that could affect energy consumption. Monitoring equipment can cost a lot of money and cannibalize human resources adding to hidden cost. Yale discusses this it its progress reports and the University of Vermont has the same problem (Erickson, 2014). Both schools decided that it was too expensive to bother calculating exactly what savings were realized. They instead adopted a system which may as well just be called the "Guesstimation" (Yale, 2012; Erickson, 2014). Their method of calculating savings is more advanced than Grenfell's but not by a huge margin.

Eliza Davis (2012) has developed a toolkit to help universities measure energy savings. The comprehensive toolkit gives examples and predictions for many different initiatives from double

sided printing to exterior light posts. She explains in detail how to measure every aspect of energy usage and how to best make estimations when data is not available.

A formal measuring system needs to be adopted. This system could be a combination of other systems or something entirely new. The more accurate, the better, but perfect technology is not a requirement. Grenfell does not currently have sufficient technology or an adequate alternative tracking technique. This doesn't mean that developing one would be a significant barrier.

9.0 Opportunities at Grenfell

Section 4 indicates Grenfell's bottom of the pack sustainability rankings, scoring just 22% (Beringer, Wright and Malone 2008). With so much room for improvement, there is no need to take on the most difficult projects. If these projects were not successful then the GRF would be shut down in the first few years. Furthermore, large projects would tie up significant portions of the fund and not allow any other initiatives until the fund was repaid. The best route is to focus on the easiest opportunities first. Grenfell specific research has already identified a large number of these (Pottle and Reagan, 2012; Reagan, 2012; Lam, 2012; Blakelock, 2013; Andrews, 2003).

Grenfell energy usage was obtained from September 2012 to January 2014 and is available in the appendix. The average monthly usage over that period is 983737 KWH at an average monthly cost of $101356. As expected, usage increases during the winter with shorter days and significantly larger heating requirements.

Drawing on personal experience, previous research of Grenfell, interviews and external sources there are four areas which could be targeted first that if effective could come close to paying the salary of the sustainability coordinator in the first year. These opportunities would cost a very small amount of money but set the stage for bigger and better initiatives in the future once the university community sees what is possible. The areas identified are: Housing, lighting, computing, and vending machines.

9.1 Housing

It is difficult to determine exactly how much energy housing is using. Using the method adopted for billing (Hulan, 2014), and the information provided on power usage and sq footage of buildings (Duffy, 2014) and then corrected slightly for a very conservative estimate on undercharging it can be estimated that housing uses 8% of the total overall energy consumption of the university. It is the belief of the author that this figure is drastically lower than the actual amount, but due to the method of estimation currently used and lack of updated data since construction of three new buildings that skew the ratio 8% will be used as the calculation of base consumption despite possible inaccuracy.

Students who live in housing have full control over heating and lights but do not pay a separate utility fee. Other than personal preference there is no incentive to conserve. According to a former residence advisor there is a great deal of waste that occurs daily. "Lights are always left on. Always. In individual bedrooms, the entry porch and bathrooms – whether it's just

between classes, or the student has dropped into someone else's room down the hall or lounge, or if they've left campus for a few hours." (Lacouer, personal communication 2014). The Residence Advisor also reported frequently having to close windows in common areas in the winter, and that from time to time students would leave their bedroom open. Some of these students even left for midterm break with windows open. Lacouer stated that in some cases windows are broken and do not fully latch which is inefficient

A chalet Advisor cited almost identical occurrences. He stated that during winter rounds he would see at least one chalet with windows open every night and it was usually more than one (Curlew, 2014). When asked about lighting Curlew responded that pretty much all the lights are on except for a few chalets that are clearly conscience about wasting and would hardly ever have any lights on. Students in Chalet apartments seemed to be better about leaving campus with lights on than residence students but it still occasionally happened. Curlew said that one of the biggest culprits in his opinion would be the porch areas. Curlew was not asked about solid waste management, but he offered that the removal of both bottle and cardboard recycling bins is a major problem and now refuse of all kinds is deposited in the dumpsters instead of sorted into the appropriate bins which are located far away from either chalet complex.

Both Lacouer and Curlew brought up the lights that are on in common areas permanently and cannot be shut off. There are no light switches. Both believed that it should be possible to reduce the level of lighting in these areas without compromising security.

Both Lacouer and Curlew said that investment into things like motion sensor lights, automatic thermostats in common areas, and higher quality windows would go a long way and would be welcomed, but that in their opinion wastage was so high that it could also be reduced by "self-policing". A couple ideas were to do things like create funny signs or shock value fact posters about energy usage. Lacouer suggested that a competition be held with prizes awarded to the floor or apartment unit which improves the most, recalling a successful competition she was a part of at York.

The Atlantic Campus Climate Challenge (known as C3) is a competition for residences to compete against each other and see who can reduce their energy usage by the most. In 2011, the winning residence reduced its energy usage by 34% (CBC News, 2011). According to competition organizers consumption remains lower than pre competition levels even after the competition ends (Campus Climate Challenge, 2012).

In 2011 Grenfell Campus was invited to join the challenge through the Grenfell Campus Student Union. Attempts to secure funding for prizes and resolve the measuring issues in order to participate were unsuccessful.

Anecdotal evidence exists that students who live in student housing do not understand the cost of electricity and this causes them to waste (Coutre, 2014). One student tells a story about how he let another student from Grenfell housing move in to their off campus apartment for 18 days. For 15 of those days the student offering a room was out of town and returned to find all heaters in the house on maximum with the bedroom window open. The electricity cost for that month roughly triple the average cost without the student from housing.

Konoenko (2014) uses data from North Carolina to show that a thermostat setback policy should save 8%. A summer housing policy can save another 7%. North Carolina does not have the harsh winters of Newfoundland so these savings could be expected to be even larger at Grenfell. Either of these two policies would result in significant amounts of money saved. If these policies were used in association with several other reduction initiatives then serious savings could occur.

A 15-20% reduction in housing energy usage is a reasonable goal given the current situation and the gains of other universities. It would cost very little other than human resources to implement, and any cost associated with policy creation or signage could be covered easily by the GRF. If energy usage in housing was reduced by 15% the resulting savings would be $9730 per year.

9.2 Lighting

A quick walk around campus will reveal that lights are frequently left on in unnecessary areas at times when the areas are completely secured and have no access. For example, the Food court is lit up all of the time. One reason for this is probably security purposes, but if all entrances to the food court are secured and the area was thoroughly swept for any stragglers before locking it down, how could anyone enter in the first place? The cafeteria lights are on several different independent chains to provide a variety of lighting for entertainment purposes. This area, like many others such as the pool and the forestry center, could be darkened to some degree after hours and save energy. This must be possible as the library has all lights turned off at night. This area should be just as much of a security concern given the value of equipment and books. Hallways are another example. It should be possible to turn off half of the lights in hallways after hours when the only people on campus are residence students and most of the building is secured.

Offices and classrooms are not all on a central system. Most have their own light and heating adjustment options. Unlike housing, it is not known what level of wastage takes place but certainly some occurs. Hallways, offices and classes do not always need the lights on in the day either if natural lighting is available. The ability to turn off lights remotely in offices is good, but the same needs to be done in hallways. The University of Maryland installed remote switches where possible, upgraded lights to provide the same illumination coverage with fewer lights and reduced lighting overall by more than 50% (Kowal, 2009).

It is possible to turn off exterior lighting as well because this is done for earth hour and earth day on a somewhat regular basis. If it is not too dangerous to turn off exterior lighting for these special events, they should be able to be turned off on a more consistent basis.

Universities have seen significant savings from targeted lighting policies and upgrades. Dublin City University was able to save 12% of overall energy consumption on the buildings selected for improvement (Sustainable Energy Association of Ireland, 2007).

Inter office competitions, policies which dim lights at night and utilize "daylighting" and campaigns such as the ones proposed by for housing (Blakelock 2013; Curlew, 2014; Lacouer, 2014) would not carry a significant cost, could be implemented without halting any academic or recreational programs for improvement and make a big difference.

Even small changes add up quickly. According to information from Natural Resources Canada and the US Energy Information Agency lighting energy usage accounts for usually around 10-31% of the institutions total (Esource Companies, 2003). Lighting is the second largest user of electricity other than heating costs or cooling costs in warm climates. Most estimations place lighting costs at around 25% of total usage (Phillips, 2011).

For estimation of Grenfell savings 14% was used as a baseline. 14% was selected because the cold climate likely means a higher heating cost and therefore lower lighting cost compared to other North American Universities in more temperate climates. Presuming lighting could be reduced by 15% this would constitute and annual savings of approximately $17,027.81.

9.3 Computing

Universities have a wide collection of computers, monitors, projectors, and various other equipment necessary for teaching learning and researching. All of this equipment is plugged in all the time despite it not always being in use. There are a number of things which could be done to save money.

At one point Grenfell may have been considering purchasing computer software that would automatically turn off devices through a remote, central controller. It was said to cost $10 000 and offer savings of $6500 (Advisory Committee on Sustainability, 2010). It is unclear if this was based on Grenfell data or from CNA which had implemented the system. No further data was able to be found regarding computing conservation initiatives (Rowe, 2014; Mercer, 2014).

Software such as what may have been talked about can save massive amounts of electricity. Early standby modes can save up to 90% of power when devices are not in used compared to machines that are not using standby modes (University of Victoria, 2012).

"Phantom power" is when devices that are plugged in use energy even when they are turned off. Standby modes can account for up to 10% of the total energy used by the device (Pasquier, 2011). Davis (2012) recommends that "smart strips" be purchased for all dormitory rooms, office spaces, classrooms and any other areas where multiple devices are plugged in to the same space. These devices could be logged as university property and remain in place for any future tenants, making this a onetime expense. Smart strips cost $30-$50 and work by sensing when the "trigger device" is turned off and then turns the entire power bar of (BITS limited, n.d).

Estimates for how much of total power computers and accessories take is hard to calculate because like lighting it varies depending on the main purpose of the institution. A couple of different segments all apply to office spaces and auxiliary equipment. Esource (2003) shows ranges of between 2-8%.

Using a conservative estimate of 2% and provided an energy saving occurs of 5% $1216.23 in annual savings would result.

9.4 Vending Misers

Vending Misers are a simple solution proposed by Blakelock (2013). Vending machines use a lot of energy because they are on 24/7 lit up and keeping beverages cold. A vending miser works similarly to a smart strip, but with the addition of a motion sensor. The Vending Miser is able to determine if anyone is around the machine and if not it will turn off. Blakelock (2013) counted the vending machines on campus and determined that installing Vending Misers would cost $3520 and save $4200 per year. The cost of the Vending Misers is a one-time expense.

9.5 Opportunities from survey response

Many of the suggestions brought forward from the staff and faculty survey (as well as from the Blakelock 2013 student survey) were not fully looked into for the purposes of this paper. The most popular response when asked what staff and faculty would like to see implemented was improvement on waste management. Staff and Faculty do not believe that recycled waste is actually being recycled and want to see more accountability in this sector. Other popular responses included Heat and lighting improvements, water conservation and quality concerns, paperless initiatives, car free and transit ideas, and improvement in food quality/sustainability. Other less popular ideas were bold such as major building retrofits – especially in regards to renewable energy sources. Question 6 could have an entire paper written on it. In fact, some of the suggestions were detailed enough to have a whole paper just on one response.

The responses in this section also show that some of the respondents who did not support a fund or paying into a fund answered that way because they believe that it is the University that should be fronting these costs, not the users. Some respondents stated that the University should be bolder when deciding what projects to tackle. It should take on larger, more ambitious projects that can be used to show a real commitment to sustainability.

What this shows is that there is indisputably a huge amount of potential at Grenfell, most of which has not been pursued yet, but that people genuinely want to see pursued.

9.6 Discussion

Combined, the four main opportunities discussed above would cost roughly $6000 in addition to hidden costs associated with any studies or human resources. The total savings from these initiatives alone would equal $26124 after expenses. Coupled with awareness and educational campaigns even more savings could be realized. The projects would create a new area of research for students who could monitor their success and help to implement them. The easy to

notice aspects of these initiatives like the vending miser can have a poster close to them which points out the type of things that are possible and encourages community members to submit their own ideas for a loan.

The estimates presented in this paper are just that – estimates. There is not a high degree of precision possible with the limited information available. The numbers are based off of sound research and accepted averages within SHE. There is a chance that these estimates may be higher than is realistically possible but there is equal chance that actual savings could far exceed the estimates presented. The goal was to indicate that potential projects for a GRF exist without having to look very far.

Before action is taken more specific and formal cost-benefit analysis should be completed.

10.0 Conclusion

Grenfell Campus is right at the tipping point of becoming a leader in sustainability through development of a Green Revolving Fund. Sustainability declarations, awareness events and educational campaigns alone just simply do not equate to tangible progress. The campus has nearly everything that is required to move forward: A mandate, support from students and staff, a body that can oversee the Green Revolving Fund, baseline data, curriculum which supports further research, and projects just waiting for funding approval. The only things preventing Grenfell from becoming an Atlantic Canada center of environmental excellence is the adoption from governing bodies of a Green Revolving fund, the initial monetary investment, and an individual dedicated to bringing all of these factors together and making it happen.
A GRF would place Grenfell at the crest of an innovation wave that has only just started sweeping over North American Higher Education. The GRF would be used as a competitive advantage in student recruitment, a research tool, a driver of entrepreneurship, and be financially lucrative. Most importantly, it is just the right thing to do.

> "Not only do universities educate our citizenry with interdisciplinary knowledge, but they are large, prestigious, and influential institutions in their own right, capable of having large impacts on the environment as well as…on local and global communities." – Christoper Uhl and Amy Anderson, *Green Destiny: Universities Leading the Way to a Sustainable Future. 2001*

The above quote is a good argument to why Universities need to be the first to take on climate change and then disseminate the lessons and encourage the communities that surround them to do the same. Responsibility for global sustainability does not rest solely on the shoulder of any one person, group, organization or institution. Lack of individual accountability for a global problem does not abdicate our responsibility to take action locally regardless. David Orr, who has ushered Oberlin College toward its goal of carbon neutrality, believes that Universities must stop talking about the problem and start dealing with the problem.

> *"Students hear about global responsibility while being educated in institutions that often invest their financial weight in the most irresponsible things. The lessons being taught are those of hypocrisy and ultimately despair. Students learn, without anyone ever telling tem, that they are helpless to overcome the frightening gap between ideas and reality. What is desperately needed are a) faculty and administrators who provide role models of integrity, care and thoughtfulness and b) institutions capable of embodying ideals wholly and completely in all of their operations."*
>
> -David Orr, 1994. *Earth in Mind: On Education, Environment and the Human Prospect*. pg. 14-15.

The path proposed by Dr Orr back in 1994 is one which more institutions are jumping on every day. Grenfell is perfectly positioned to go down this path as well. In order to achieve the goals set out in the 2009 Sustainability Declaration Grenfell needs to dedicate funds to sustainability initiatives through the creation of a Green Revolving Fund and the hiring of a sustainability coordinator. Grenfell could be described as a ticking time bomb for sustainability; all that is needed is for someone to push the detonator.

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Appendix A

Students' Attitudes towards Sustainability at Grenfell Survey

Background Information

Grenfell Campus has a reputation for being an environmental friendly campus, acquiring an industrial composter last year and recently adding a new graduate program in Environmental Policy to the already well recognized environmentally-based undergraduate programs. This study is designed to address student attitudes towards sustainability initiatives on campus. Information gained from this study will contribute to a better understanding of the extent of which students support or oppose new sustainability initiatives, as well as levels of satisfaction or dissatisfaction with current initiatives.

Privacy

Your answers will be grouped together with others, and individual responses will be kept strictly confidential. You are free to end the interview at any time and can skip questions if you wish.

Goals of the Survey: The goals of this survey are to (i) determine levels of satisfaction or dissatisfaction among students regarding Grenfell's sustainability initiatives, (ii) determine whether or not students are willing to support a "Sustainability Fund" at Grenfell, and (iii) determine students levels of interest regarding new sustainability initiatives on campus.

For each question, please circle the answer which best applies to you.

1. Rate your level of satisfaction or dissatisfaction with the sustainability initiatives at Grenfell? (For example: the industrial composter; the GCSU Environmental Affairs Committee)

Not satisfied		Indifferent		Satisfied
1	2	3	4	5

2. Would you prefer to have more sustainability initiatives undertaken at Grenfell? (For example: enhanced waste management and recycling; installation of renewable energy; energy conservation programs, etc.)

No		Neutral		Yes
1	2	3	4	5

3. Would you be willing to support a Grenfell Sustainability Fund, which aimed to improve the overall sustainability of Grenfell Campus?

No		Neutral		Yes
1	2	3	4	5

4. If Grenfell implemented a "Sustainability Fund" how much would be willing to pay (per semester) to support and advance sustainability initiatives at Grenfell? (Please indicate the highest amount you would be willing to contribute)

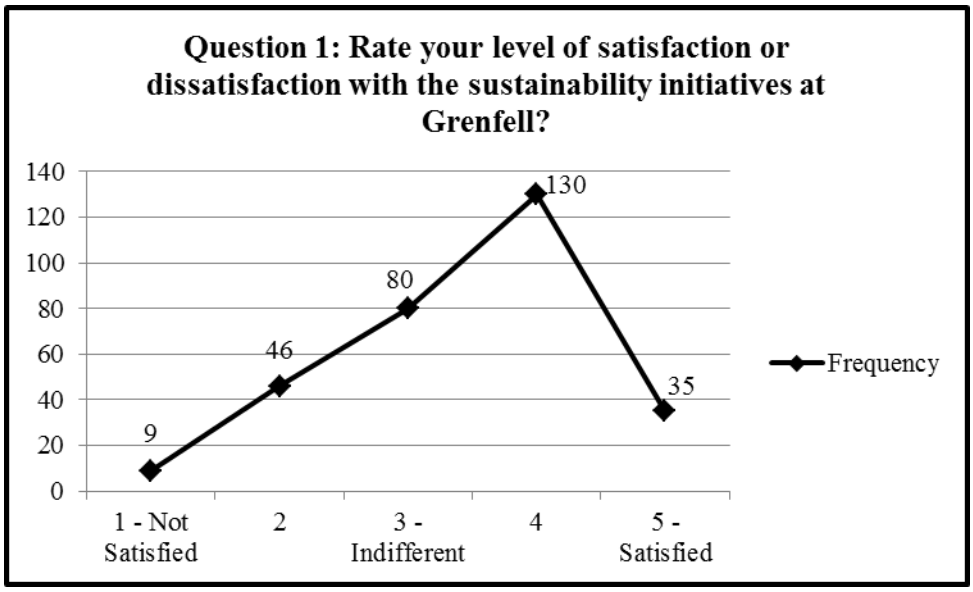
Less than $5 $5 $10 $20 More than $20 If other, please specify

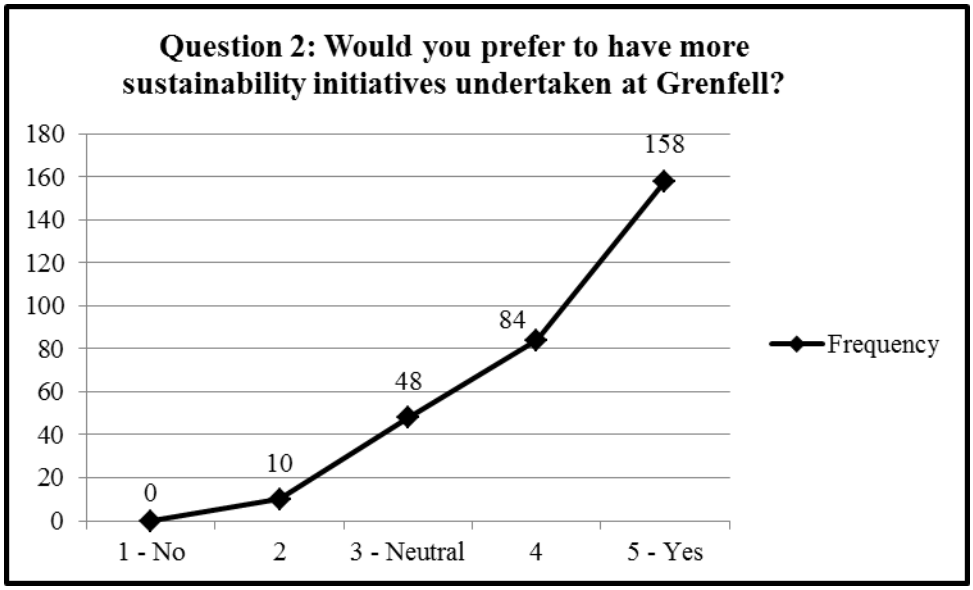
5. What sustainability initiatives / practices would you like to see implemented at Grenfell?

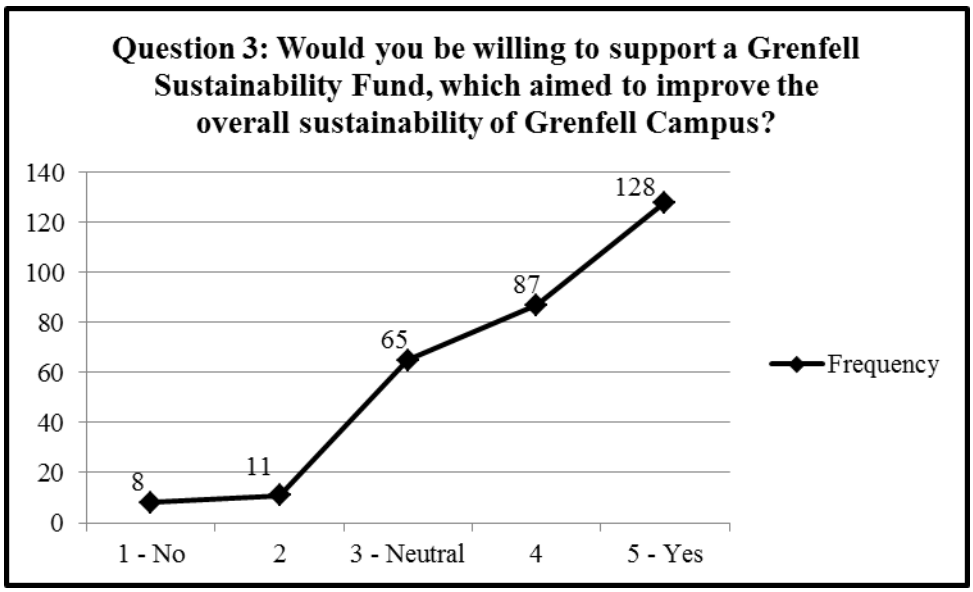
6. Please indicate which level of university you are currently in?

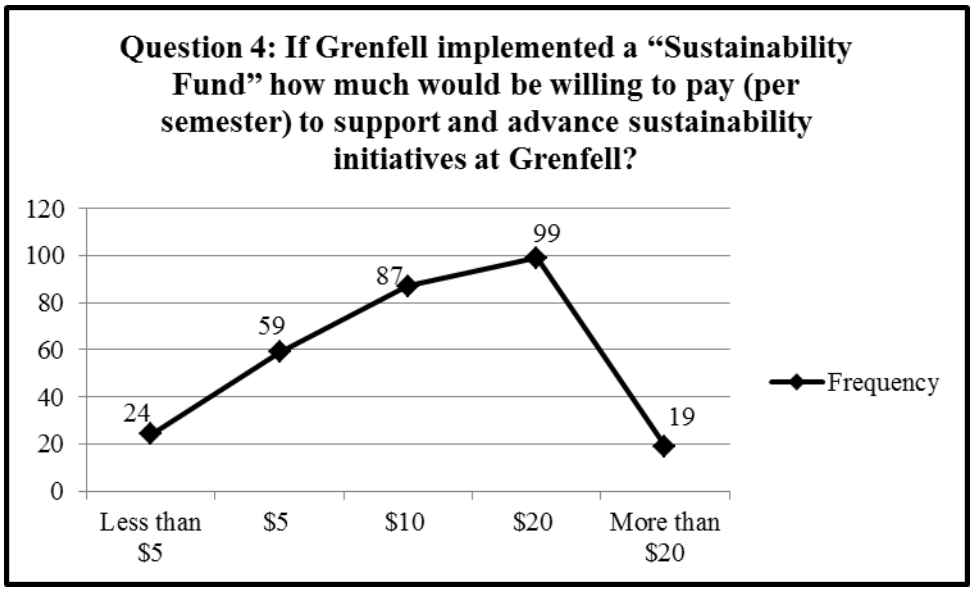
1st Year 2nd Year 3rd Year 4th Year Graduate

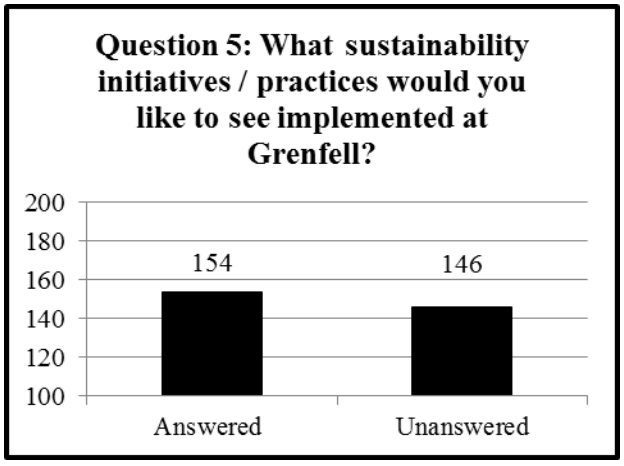
Appendix B



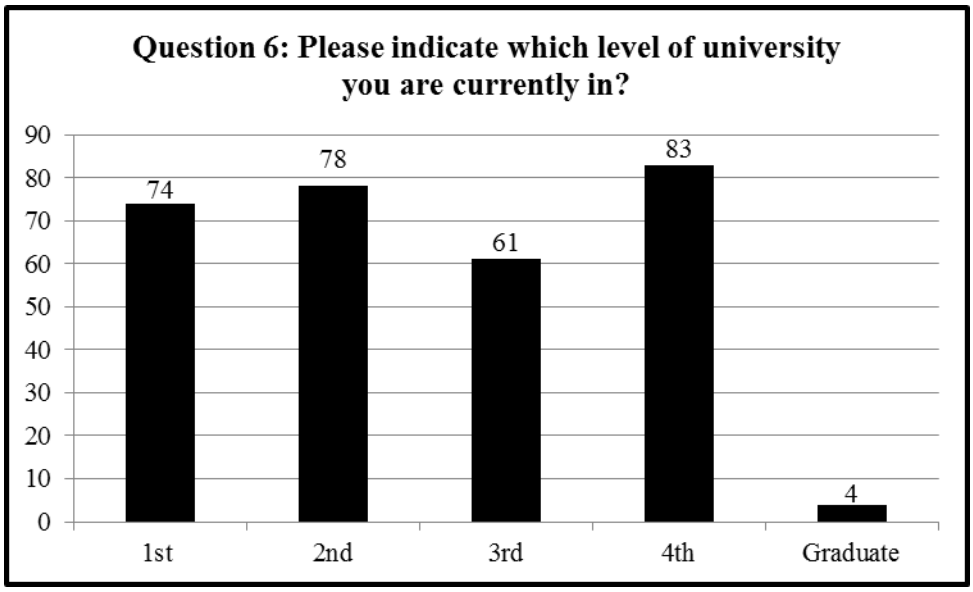



Question 3: Would you be willing to support a Grenfell Sustainability Fund, which aimed to improve the overall sustainability of Grenfell Campus?
140
120
100
80
60
40
20
0
8
11
65
87
128
1 - No
2
3 - Neutral
4
5 - Yes
Frequency


Question 4: If Grenfell implemented a "Sustainability Fund" how much would be willing to pay (per semester) to support and advance sustainability initiatives at Grenfell?
120
100
80
60
40
20
0
24
59
87
99
19
Less than $5
$5
$10
$20
More than $20
Frequency



Question 5: What sustainability initiatives / practices would you like to see implemented at Grenfell?		
Suggested Sustainability Initiative	**# of Respondents Supporting each Initiative**	**% of Total Respondents Supporting each Initiative (Total Respondents = 154)**
Recycling Program	76	49.4
Better Composting Awareness & More Composting Bins	35	22.7
Compostable / Reusable Dishware in Cafeteria	24	15.6
Renewable Energy	29	18.8
Energy Conservation (eg: Nightly Computer Turn-off, Motion-Sensor Lights, etc.)	24	15.6
Campus Greening (eg: more trees, gardens, etc.)	9	5.8
Bottle Water Ban	8	5.2
Online course work	5	3.2
Additional Water Bottle refill stations	4	2.6
Green Roof	4	2.6
Sustainability course	2	1.3
Aquaponic Greenhouse	1	0.6



Appendix C

Background Information

Grenfell Campus has a reputation for being an environmental friendly campus, a reputation based upon such things as acquiring an industrial composter and recently adding a new graduate program in Environmental Policy to the already well recognized environmentally-based undergraduate programs. This study is designed to address staff and faculty attitudes towards sustainability initiatives on campus. A similar survey of students showed that over 70% of students support a sustainability fund, and roughly 65% were willing to pay $10 or more per semester toward such a fund. Information gained from this study will contribute to a better understanding of the extent of which staff and faculty support or oppose new sustainability initiatives, as well as levels of satisfaction or dissatisfaction with current initiatives. Results will be used in my EVST 4950 independent project which discusses the viability of creating a Green Revolving Fund at Grenfell Campus.

Privacy

Your answers will be grouped together with others, and individual responses will be kept strictly confidential. You are free to end the survey at any time and can skip questions if you wish. Under no circumstances will the answer to any question be viewed as an agreement to actually pay.

Goals of the Survey: The goals of this survey is to assess the attitudes of staff and faculty compared to the attitudes of students on three levels: (i) determine levels of satisfaction or dissatisfaction among staff and faculty regarding Grenfell's sustainability initiatives, (ii) determine whether or not staff and faculty are willing to support a "Sustainability Fund" at Grenfell, and (iii) determine staff and faculty levels of interest regarding new sustainability initiatives on campus.

1. Are you a staff or faculty member of Grenfell Campus? If no, please do not proceed

Yes No

2. Rate your level of satisfaction or dissatisfaction with the sustainability initiatives at Grenfell? (For example: the industrial composter; the GCSU Environmental Affairs Committee, Vice Presidents Advisory Committee on Sustainability, Bottled water ban etc.)

Not satisfied		Indifferent		Satisfied
1	2	3	4	5

3. Would you prefer to have more sustainability initiatives undertaken at Grenfell? (For example: enhanced waste management and recycling; installation of renewable energy; energy conservation programs, etc.)

No		Neutral		Yes
1	2	3	4	5

4. Would you be willing to support a Grenfell Sustainability Fund, which aimed to improve the overall sustainability of Grenfell Campus?

No		Neutral		Yes
1	2	3	4	5

5. If Grenfell implemented a "Sustainability Fund" how much would be willing to pay (per semester) to support and advance sustainability initiatives at Grenfell? (Please indicate the highest amount you would be willing to contribute)

Less than $5 $5 $10 $20 More than $20 None
If other, please specify

6. What sustainability initiatives / practices would you like to see implemented at Grenfell?

7. Please indicate which faculty or department you are part of (Facilities Management, Student Services, Math, etc)?

Appendix D

Survey results: First number is number of respondents who selected that response, second number is percentage of respondents who selected that response. Questions 6 and 7 have had responses generalized for analysis purposes. Question 6 only was answered by 26 respondents, but some respondents stated multiple ideas. The ideas were tallied individually, so the total number of people supporting ideas exceeds the number who answered the question. Percentages have been rounded to the nearest one percent for all questions, so totals may not add to 100%.

Question 1:

Yes: 42 100%

No: 0 0%

Question 2:

Not satisfied:	3	7%
Mostly unsatisfied:	10	24%
Indifferent:	7	17%
Mostly Satisfied:	15	36%
Satisfied:	7	17%

Question 3:

No more sustainability initiatives:	0	0%
A few more sustainability initiatives:	5	12%
Neutral:	7	17%
Quite a few more sustainability initiatives:	18	43%
Lots more sustainability initiatives:	12	29%

Question 4:

Absolutely unwilling:	1	2%
Mostly unwilling:	1	2%
Neutral:	13	31%
Mostly Willing:	19	45%
Absolutely Willing:	8	19%

Question 5:

None:	8	20%
Less than $5	2	5%
$5	4	10%
$10	6	15%
$15	3	7%
$20	15	37%
More than $20	2	5%
Other:	1	3%

Question 6: total respondents: 26

Improved Waste control/compost/recycling:	10
Timed thermostats/heating efficiency	5
Motion Sensor/high efficiency lights	6
Renewable energy	5
Car free incentives/better transit/university vehicles	6
Food improvements	4
Gardens	3
Aboriginal sustainability	1
Energy tracking	3
Sustainability fund/carbon offset fund	2

Sustainability manager	1
Water conservation/quality improvements	6
Energy conservation (no specifics mentioned)	1
Sustainable grounds keeping	2
Projects as part of course work	2
Paperless initiatives (teleconferencing, online agendas, publications)	5

Full answers to question 6:

-Energy Management Waste Control & recycling

-Timed thermostats and motion sensitive lighting would be great moves forward. Solar on the roofs would be a nice gesture as well (might be able to get a bit of hot water for the chalets).

-Sources of green energy, such as windmills. Green roofs.

- Incentives for walking/biking to work - A push for a better bus service in Corner Brook - Better food in the cafeteria (right now not a lot of local or healthy options)

-I would like to expand the use of the composter to the community. Have composting containers outside building for community members to drop their things. Also, I think that organizations (especially Grenfell) should rent out composting containers when events are going on. Most community and even Grenfell events that happen outside of campus do not have composters. It would be so easy to just rent one from campus!

-Solar panels More access to composting bins More information about how to be sustainable Paper recycling program that actually recycles paper (when the cleaners come to my office they dump my paper recycling into the regular garbage). Initiatives / incentives for car-pooling

-Local Food Box Bicycle Recycling On-campus Food Growing volunteer gardens aboriginal sustainability

-Use energy efficient light bulbs have a system that shuts down light when not in use (like in the new extension) Tracking of energy use no paper use for catering

-If Grenfell wants to become a more sustainable campus then they need to put the funds and resources towards it. We talk about sustainability in the strategic plan but seem to make no effort to become a more sustainable campus, to me this seems like an effort to save face. We have someone working on composting efforts and have made great strides in that area. Why not take that position and reclassify it into a Sustainability Manager position. This person can work with government along with internal and external stakeholders to make this a truly sustainable campus. It's time that we as a university start to walk the walk. Some initiatives that this campus should be looking at are: Water conservation Energy conservation Turf management (campus grounds) Higher focus on waste management and recycling Sustainability initiatives with 4th year enviro student Community outreach

-None come to mind at the moment.

-Grenfell should have its own water purification system An experimental wind mill A salad bar in the Food Court

-Energy efficiency retrofits for older facilities (Fine Arts, Forest Centre, Arts and Science, etc.) for heating and lighting; Recycling program for all recyclable containers and/or plastic bags; More accessible chilled and filtered water bottle filling stations across campus; Greater use of teleconferencing and distance education tools to reduce travel-related GHG emissions; More accessible local and sustainable food choices on campus; Greater efforts to move from paper form-based administrative processes and procedures to paperless electronic ones; Consideration of a carbon offset fund to move the campus towards greater carbon neutrality; Continuation of the Environmental Policy Institute's Grenfell Campus 2010-2011 Carbon Footprint project, potentially using the provincial Office of Climate Change and Energy Efficiency's municipal carbon calculator to reduce the workload on researchers and facilitators

-All the building needs to be updated to minimize energy use...better lighting, limit use of heat, etc.

-It's not about what I would like to see - it should be about what Grenfell needs, and what the institution has the capacity to support.

-Here are some ideas: 1. provide recycling that makes users confident that it is being handled properly at the other end. We want recycling accountability. 2. fund demonstrator projects of both solar and wind energy. 3. retrofit movement-sensitive lighting throughout all buildings (as you enter a room, lights come on....when everybody leaves, they shut off automatically). 4. get the geothermal heating in the forestry building fixed and then get it running. 5. more than anything, remove the water-bottle ban on the campus. Corner Brook has the worst tasting water in Atlantic Canada due to its high levels of chlorination....let us get half-decent water to drink. Drinking a chlorine cocktail every day is like slowly poisoning ourselves, and makes the ingestion of THMs even more threatening. 6. provide a transportation link between campus and city hall where the bus predictably runs every 15 minutes. Students in residence need easier access to food shopping and this will keep the need for a car down. 6. provide more bike racks. 7. introduce a solar aquatic system for treating the sewage of at least one residence building. This installation could be used as a tourist attraction and would pay for itself. The SAS in Bear River was the town's top tourist attraction when it was running. 8. faculty and staff pay five dollars a year for the privilege of driving our cars at work. At Ottawa U, they have to pay 80 bucks a month to park. Start charging faculty and staff something competitive for on-site parking and put that money directly into the Sustainability Fund. Note: the money MUST go into the Sustainability Fund rather than a general operating fund or I would not support this initiative. 9. design a green roof for one of the many flat roofs on campus. Incorporate its design into course work.

-No paper MUN publications

-More recycling of bottles and cans. No one seems to know what should go in a blue box, and no one knows what happens to it all. Also, more emphasis placed on shredding paper for the composter, and more emphasis placed on having people bring food waste from home to the composter (make it easier somehow?)

-full recycling grey water system green walls effective passive solar power energy efficient vehicles
I'd like to see them stop cutting down the trees around the campus in order to pave more earth/grass to support cars that stink up and further pollute the already reeking environment with even more fumes. Remember trees and birds and other living things? Remember walking and car-pools? Clean drinking water would be nice.

-More recycling of organizational waste (e.g., electronic equipment, textbooks), more high profile projects that are visibly supported by senior administration--we need to see that it is a priority

-I would like to see some other initiatives beyond water and waste management. I would like to see an experimental all-year-round greenhouse, with vegetables given to students in the residences, to promote healthy eating (or at least, have greenhouse vegetables for a semester-by-semester 'garden party' for the residence and general students). I think the university should also acquire 2 or 3 beehives.

-I am not familiar with how these programs work.

-a better effort to recycle. there aren't enough recycling containers in general and hardly any for bottles/cans. -more of an effort to be a paperless campus. WAY too much paper being used, like all the paper posters everywhere -more filtered & chilled water fountains like the one in the library

-Mandatory composting on campus.

-more awareness of existing initiatives the university itself should pay for these initiatives without imposing user fees of any kind; it should be part of institutional culture. In fact, the university has a responsibility to do this

-New academic buildings should be equipped with green technology such as geo-heating in an effort to shift towards LEEDS certification. Other ideas can include green projects such as greenwalls, designs allowing for natural heating/cooling.

Question 7

Number of respondents:	30
Administration/ Admin and finance/facilities management	5
Fine Arts	2
Social Science	3
Environmental Policy Institute	2

Division of Science	2	
Business	1	
Community Education		1
Marketing and Communications		1
Environmental Studies/science		3
Recruitment	2	
Student Services	2	
Registrar	1	
Arts	2	
English		2
Math	1	

Popular Media Discourse Surrounding Issues of Labeling and the Human and Environmental Health Impacts of Genetically Modified and Non-Organic Food

Kelly Keresteci
Grenfell Campus
Memorial University of Newfoundland

The issues surrounding the use of genetically modified (GM) organisms within the food supply has sparked worldwide controversy. Likewise, non-organic food products have continuously ignited concern among consumers in regards to human and environmental health. Both GM and non-organic food products have significantly impacted consumer choice. This is due, in part, to labeling practices that do not meet consumer satisfaction. In addition, the Food and Drug Administration (FDA) does not require mandatory labeling for such products. This paper outlines such issues within popular media discourse drawing on content analysis to aid my research in understanding and critiquing everyday discourse of written documents on the issue pertaining to labeling and the human and environmental health impacts of GM and non-organic food.

Introduction and Rationale

Organic food is one of the faster growing food sectors in the Western world (Klintman, 2002), and its labeling criteria have become of increasing economic, social, and environmental interest to several groups of actors in society. According to Klintman (2002), a common assumption for many consumers who purchase organically grown food products is that the term 'organic' implies that the food is produced without synthetic inputs, thus releasing fewer chemicals into the environment during crop growth, and that organic product revenues support those who produce environmentally sound and much less harmful products.

Although neither the United States nor Canada requires mandatory labeling of genetically modified (GM) foods (Morgan & Goh, 2004), their governments have stressed the importance of adapting regulations that pertain to the concern for the standardization, certification and labeling of organic and GM food.

Recent popular media items, however, have highlighted instances where organic and conventional food producers have been suspected of violating legislation pertaining to organic and non-genetically modified (non-GM) food labeling. Mislabeling food items and using genetically modified food products raises complex policy challenges in regards to health, food safety, environment, trade, and ethics.

In addition to the important considerations of business ethics, environmental health, and human health and safety, it is important to note that questions regarding the credibility of food certifications places increasingly heavy burdens on the organic food industry to prove that organic foods are free from a number of processes, ingredients, and genetically modified organisms (GMOs). Given these important considerations and significant recent increase in consumer concerns, in regards to environmental and social impacts of food production (Giannakas, 2001), it is critical that consumers become aware of the certification process of organic food, traceability requirements in GM foods (and what this entails), and priorities behind food labeling.

The current research will critically analyze relevant popular media items and academic literature to elucidate current discourse surrounding various relevant themes. These themes include the implications of suppliers' organically-labeled food credibility, how mislabeling can affect consumer and market behaviour towards the acceptance of organic food, the enforcement protocol that recognizes the importance of annual onsite inspections of organic food crops, the use of GM crops throughout North America and their relationship with environmental and health-related concerns, and the debates concerning problems associated with what part of the food process chain should require organic labeling. This paper will also address issues related to organic and non-GM food labeling criteria.

Methods

Content analysis is an established technique designed to aid the researcher in understanding, critiquing, and analyzing the normal, everyday discourse of written documents and other relevant mediums with an aim of uncovering relevant patterns and themes (Beck, Campbell, & Shrives, 2010). This method can assist researchers in making sense of complex facts and information from unstructured formats such as newspapers, online popular media articles, documentaries and other forms of media (Altaweel & Bone, 2012). In the current research, content analysis will be employed to analyze how popular media items, such as online news articles, websites, and documentaries, communicate information regarding organic and non-GMO food labeling. This analysis will focus on reported instances of food product mislabeling, and also elucidate those themes in popular media which address questions of the importance of knowing the source and credibility of food identified as organic and non-GMO.

To achieve the goals of this research, several alternate data collection methods were considered. The qualitative research techniques of surveys, face-to-face interviews, and content analysis were evaluated. Each of these techniques has pros and cons, but a content analysis approach is better suited for analyzing the discourse surrounding organic and non-GM food labeling.

As a potential data collection method, surveys allow for the uncovering of unobservable data such as people's preferences, opinions, and knowledge about the subject in question. Surveying is also an efficient way to collect data about a population if the population is too large to directly observe (Bhattacherjee, 2012). However, there are limitations to surveys. Surveys are a form of communication involving questions regarding knowledge, attitudes, and behaviours that can "oversimplify components, and [neglect] the interactions of factors that may govern behaviour" (Robelia and Murphy, 2012, p. 300). Surveys should also, according to Wong (2010, p. 171), "have an expanded time lapse in order to determine a change in people's perception of complex environmental issues". Since such a long-term analysis is beyond the scope of the current research, surveys are not an ideal data collection technique for this project. Conducting interviews was another method considered for this project; however, similar to surveys, this method can be time-consuming and resource-intensive (Bhattacherjee, 2012). Surveys and interviews are thus inappropriate for this study. A content analysis approach is an ideal framework to explore in-depth and understand complex environmental and social issues. By applying this research technique to popular media items, better data will be provided for critique, and there are no restrictions on time or space like that of

interviews, questionnaires, observation, etc. (Holsti, 1960). According to Altaweel & Bone (2012),

> the reporting of environmental issues in public media helps to form people's perceptions about their surrounding environment. Perceptions are influenced in part by the context in which issues are reported as media outlets frame stories that in turn affect how readers respond to the reported message (p. 599).

The media plays an important role in informing the public about current environmental issues such as those pertaining to the suspected mislabeling of organic and non-GMO food products.

Literature Review

Environmental and Social Concerns

Since the introduction of biotechnology in crops for food production, public attitudes regarding the genetic modification (GM) of food have reflected many uncertainties regarding the use of such technology. These uncertainties according to Teng (2008) include: (1) issues pertaining to safety regulations and labeling criteria that deal with international trade; (2) food safety and side effects on human health; (3) social, ethical and economic issues; and (4) the environmental effects from the biotechnological crops. Like GM products, non-organic food, according to public concerns, is skeptical due to: (1) the content of organic ingredients in food products; (2) whether or not organic food is greater, equally or less nutritious than conventional food products; and (3) whether organic food practices are more environmentally sound in comparison to conventional or GM methods in agriculture (Nestle, 2006). The objective of this literature review is to examine the environmental and social concerns with non-organic and GMO food products through scholarly works that discuss such matters within North America, Europe, and Asia.

As one of the most prevalent concerns, genetic engineering (GE) poses a threat to overall environmental biodiversity (Kingsolver, 2002). Genetic engineering is another term used for organisms that contain manipulated genetic material from other organisms. Kingsolver (2002) discusses the importance of gene diversity within plant species and even among all organisms that have ever lived. Human's adaptation of traditional agriculture influenced the rich diversity of plant species which naturally helps to ward off all types of pests and withstand extreme weather conditions. Industrialization and associated human population growth has largely depended on farmer's use of seeds. For generations, these seeds gave been passed along from farmer to farmer which has left societal reliance on farmers' use of seeds to ease hunger and promote a safe agricultural practice for humans and the natural environment. With the introduction of GM seeds over the past several decades, Kingsolver (2002) explains that "if genetically reordered organisms escape into natural populations, they may rapidly change the genetics of an entire species in a way that could seal its doom" (p. 46). In other words, Kingsolver (2002) believes that GM seed companies are damaging the integrity of plant and animal species through the insertion of genes from one organism into another.

Non-organic and GMO food products require intensive regulatory practices and safety procedures in order to be proven as a 'substantial equivalence' to conventional

food products. Substantial equivalence for the foods produced by modern biotechnology in support of GMOs according to Moseley (2002), "embodies the idea that existing organisms used as food sources (and the foods themselves) can serve as a basis for comparison when assessing the safety of a food or food component that has been modified or is new" (p. 129). Moseley discusses the importance of a safety and regulatory system in the European Union pertaining to novel food products due to public uncertainty and distrust of foods that are not supported by natural functions of nature. In Europe, the safety of GM food is controlled by the Novel Foods and Novel Food Ingredients Regulation which has,

> introduced a mandatory premarket safety assessment for all novel foods…[these foods]…must not: present a danger to the consumer, mislead the consumer, or differ from a food it is intended to replace to such an extent that its normal consumption would be nutritionally disadvantageous to the consumer (Moseley, 2002, p. 129).

Similarly, Harlander (2002) explains how the United States requires a safety evaluation of all GM crops which is carried out by three agencies: the US Department of Agriculture (USDA), the Environmental Protection Agency (EPA), and the Food and Drug Administration (FDA) (p. 132). Each agency plays a role in either the safekeeping of the environment or human health. Harlander (2002) also describes 'substantial equivalence' as a method of comparing GM crops to their conventional counterparts which is focused on "nutritional equivalency, levels of natural toxicants, and the potential for allergenicity", along with other factors regarding environmental conditions (pp. 132-133).

Organic food, in order to be considered certified organic, must also follow strict regulations. These regulations are strictly enforced in order for organic farmers to make sure they manage their soil in a healthy manner (Nestle, 2006). Nestle (2006) states that "in order to obtain organic certification, farmers have to follow strict rules about the use of manure to make sure that harmful microbes are destroyed, and they are inspected to make sure they do" (p. 51). In Canada, the approval of organic produce is regulated by the Canadian Food Inspection Agency.

The public's concern in regards to health impacts also brings controversy in regards to the consumption of GM food. Although biotechnologies allow for the modification of food in terms of look, taste, and nutritional value (Kondro 2002), the public insists that they do not want to take the risk of consuming food that does not go through certain regulated procedures. According to Keogh (2012) "GMOs' skeptics worry that prolonged exposure to such foods promotes allergies and even cancer" (p. 498). Keogh (2012) explains how there has not been enough substantial evidence for the effects of consuming GMOs; however, the studies that have been conducted have been too short. Consumers are concerned about the long-term effects GM food has on human health, since genetically manipulated organisms promote herbicide tolerance, insect resistance, and other traits that could cause potential human health risks (Keogh, 2012). Organic food skeptics on the other hand argue that since organic food is grown in composted manure, food is more exposed to dangerous microbes making it riskier to consume in comparison to conventional food products that have been grown with chemical fertilizers (Nestle, 2006). Although studies suggest that the risk of contaminated

food is doubled in organic fruits and vegetables, there is only a four percent likelihood of consuming a contaminated organic product (Nestle, 2006).

In the case of China, Lan (2006) explains how people living in different economic conditions have very different views of the consumption of GM food products. For instance, those living in better economic conditions believe that GM food would "threaten the natural order to things and be fundamentally unnatural, as well as dangerous for future generations" (Lan, 2006, p. 263). However, those living in underdeveloped areas of the country have "a greater willingness to support or encourage the use of biotechnology in agri-food production" (Lan, 2006, p. 264). With lower economic conditions, people are more willing to risk their own health for 'nutritious' food grown with GMOs and they also support such technology as it can produce food at a faster rate. Moreover, in some cases non-GMO and organically labeled food products can be more costly. With strict regulations, safety measures, and monitoring processes, the costs for such products will inevitably be higher than conventional food because of efforts enforced in the regulation process (Harlander, 2002). Also, because of public attitudes regarding organic and non-GM food products, most consumers are willing to pay greater expenses for products that are labeled as non-GMO and certified organic.

Rapid technological innovations such as conventional agricultural practices, have contributed to numerous environmental effects. Of these, the most notable is extensive natural resource degradation and pesticide residue found in complex ecological systems (Gopalan, 2001). Today, soil productivity and the loss of soil nutrients is due to large-scale conventional agricultural practices that use pesticides and chemical fertilizers, which over time has been degrading agricultural land (Gopalan, 2001). Nestle (2006) explains how produce grown using such practices is worrisome since it is grown in "non-sterile environments" (p. 47). Unlike conventional food, organic food is grown in nutrient-rich soil with no chemical additives (Nestle, 2006).

One of the least understood and questioned aspects of organic produce is the public concern in regards to whether or not GM food can be considered organic even if it grown through organic regulations. The certification and labeling of organic produce typically implies that the nature of the product is *natural.* This means there are no chemical additives or preservatives, produce are grown in a sustainable manner, the final product in supermarkets must contain at least 70 percent organic content, and lastly, there are no modified or altered genes within the produce. However, the question appears to be whether or not GMOs are 'natural'. Although the FDA may approve of GM foods as 'natural', the public may believe otherwise which may indicate an untruthful or at least questionable labeling practice among food suppliers.

Labeling

The public is skeptical about the integrity of food products labeled as 'Certified Organic' and 'GMO free.' Some of the main areas of discussion within this paper pertaining to the discontent with biotech food products includes: (1) labeling regulations of GM farm products, (2) labeling requirements, (3) the misleading implications of labels, and (4) the overall public attitudes regarding the approval and acceptance of the necessity of the labeling of GMO free and organic foods.

Labeling regulations of GM farm products, according to Lan (2006), promotes sustainable development initiatives and protects the biotechnological research process

within the industry. Sustainable development initiatives are derived from the notion that GM food products can aid in the amount of annual growth, thereby increasing the production of food especially in underdeveloped areas of the world. It has also been argued that GM foods contain altered genes that ward off pests for ideal growth, and can survive harsher climate conditions in comparison to non-GM grown food. Bio-safety management, as defined by Teng (2008) is "a generic term used to cover any aspect of safety issues associated with the potential or actual effects of GMOs on the ecosystem" (p. 239). This has been suggested as a precautionary management strategy that can ease the anxiety of the public in regards to the consumption of GM food products. According to Hart (2002),

> on May 27, 1998, a coalition of rabbis, Christian clergy, biologists, and consumers sued the U.S. Food and Drug Administration for failing to require safety testing and labeling of genetically engineered (GE) foods. The lawsuit charged that the FDA's policy endangers public health and violates the religious freedom of individuals who wish to avoid foods that have been engineered with genes from animals and microorganisms (p. 71).

The use of GE of foods is supposed to undergo "extensive food and environmental safety testing before being introduced into the marketplace" (Harlander, 2002, p. 132). The notion of modified genes within food products causes tension within the public due to the knowledge that it is difficult to avoid the mixing of GMOs during international trade of food products, especially in the United States and Canada where there is a strong possibility of crop cross-pollination between non-GMO and GMO fields (Hino, 2002). Biotechnical research processes help to ensure the safety of the product for consumption, but the question from the public as it stands is: if the food has been deemed as "safe", then why is it necessary to implement bio-safety management, biotechnical research, and other forms of safety protocol to ensure its safety for consumers? This is why is it essential to implement labeling regulation criteria to GM food products since the public has the right to know what they are buying, and how it effects the social and natural environment.

As for organic food products, in the European Union "regulations identify soil fertility management, crop rotation, appropriate choice of crop species and varieties, recycling of organic materials and judicious use of fertilizers, soil conditions and plant protection products as 'essential' elements of organic plant production system" (Hartemink, Raster & Jahn, 2012, p. 82). Such regulations reinforce the viability of organic agricultural practices.

Along with labeling regulations, labeling requirements is another area of discontent. In the United States mandatory labeling is not required as long as the product is of "substantial equivalence" to its non-GM conventional counterparts (Harlander, 2002, p. 133). The Food and Drug Administration (FDA), according to Hart (2002), does not require labeling or premarket approval. Kondro (2002) explains how "mandatory labeling can be problematic due to the cost to the industry and the conflicts it would raise during international trade" (p. 1046). Without mandatory labeling, millions of Americans consume GM products daily without their knowledge, however the FDA claims that GM foods are safe, ethical, and do not believe that labeling is necessary unless a gene from a well known food that causes allergies has been used (Hart, 2002). Although labeling

criteria is up for debate, the FDA according to Hart (2002), "did give some consideration to the ethical and religious implications of inserting animal genes into plants" (p. 73). However, the FDA still claims such GM foods as 'substantially equivalent' to their traditional counterparts, and therefore consumers who wish to avoid such foods for ethical and religions reasons are denied the right to do so.

In Japan, Hino (2002) explains how mandatory labeling is implemented when using GMOs. Until April 2001, transgenic plants and insect-resistant corn made with GMOs were authorized and marketable in Japan (Hino, 2002). Before the mandatory labeling system, this new technology sparked uncertainties and anxiety throughout the public. Today the Japanese labeling system, in regards to GM products, is now categorized into three groups including: those using GMOs, those not using GMOs, and those who do not segregate GMOs during production and distribution (Hino, 2002). Doing this segregates these foods and confirms their labeled validities in supermarkets. In Japan, GM foods go through scientific verification and are excluded entirely from the market (Hino, 2002), meaning the selling of GM products is prohibited in supermarkets.

Aside from mandatory labeling, voluntary labeling of organic and GMO-free occurs. Harlander (2002) explains how if manufacturers would like to voluntarily label their products, the labels must be truthful and nonmisleading. But the integrity of such labeling is questionable due to the fact that it is inevitable that contamination from cross-pollination occurs, and manufacturers establish a threshold level which specifies the amount of GMOs allowed to be within their product while legally allowing the label of "GMO-free" and "organic" to be placed onto the product (Hino, 2002). That being said, this is a form of fallacy since the food that is labeled as such do not confirm the integrity of food products.

Mislabeling food products goes against ethical business practices. In 2001, approximately eighty percent of food products that were labeled as GMO-free were in fact "positive for the presence of GM corn or soy" (Harlander, 2002, p. 134). Because of this, the public is skeptical when products are labeled GMO-free and/or organic due to the possibility that the label is misleading the consumer. Oftentimes, labels are indeed misleading and this is because within the United States, such products were not recalled because "the ingredients were approved for the use by the FDA and there were no health hazards associated with consuming the products" (Harlander, 2002, p. 134). This poses a moral issue between the industry and consumers since manufacturers are untruthfully labeling products. While it is argued that threshold levels prevent untruthful labeling of GM products, it certainly does not mean that the product is one hundred percent GMO-free and organic as the product label suggests. In both the European Union and Japan, they have initiated a threshold level of 0.5 percent in regards to GM food (Keogh, 2012) & (Hino, 2002). This means that 0.5 percent of the product can contain modified genes. Essentially, it is inevitable that a majority of products will contain some trace of GMOs due to cross-pollination and other contamination methods, and also international trade procedures.

Overall public attitudes regarding the approval and acceptance of the necessity of the labeling of GMO-free and organic foods has sparked consumer interest. Truthful labeling of GMO-free foods helps to reduce public anxiety (Lan, 2006), allows customers the right to choose between conventional and GMO-free products, and it also grants the customers the right to know more about the product (Februhartanty, Widyastuti &

Iswarawanti, 2007). Not only has there been a general lack of public knowledge pertaining to GM and organic food labeling, but as suggested by Hart (2002) and Harlander (2002), even with regulations, restrictions, and mandatory labeling practices, there is no way to assure the safety and truthful labeling of foods that are transgenic and organic. This leaves both consumers and scientists skeptical and as Harlander (2002) states, "the most controversial issue related to GM foods relates to labeling" (p. 134).

Benefits of Non Organic and GM Foods

Although there have been numerous studies discussing the negative implications of biotechnology used within agricultural practices, there seems to be another side of the GMO debate.

Due to the lack of knowledge pertaining to GM foods, many consumers in China believe that GM foods can deliver benefits to those in lower economic conditions, and such individuals would be more willing to consume such products since it could eradicate hunger (Lan, 2006). Similarly, Pence (2002) argues that land acquisition in today's developing countries require extensive land usage, and increasing crop yields of GM modified rice will serve to eradicate world hunger as approximately half of the world's population relies on the availability of rice. Lan (2006) also explains that there are "prevailing positive attitudes [toward] biotechnology in general in China significantly increase consumer confidence in GM food in particular" (p. 258). Those with a low perception of risk were also more willing to pay a premium for GM products (Lan, p. 258, 2006). However, that being said a significant amount of consumers would still rather have the opportunity to choose between GM and non-GM foods which would require labeling and regulations of GM foods. To the contrary, Teng (2008) notes that "most developing Asian countries look to biotech as a future driver of economic growth in spite of the position of the European Union in requiring labeling of GM products and certification for any imports" (p. 239).

The Institute of Food technologists (2000) also claims that GE foods provide stronger plants, improved nutrition, higher crop yields, reduced allergenicity, healthier farm animals, new ingredients, food safety improvements, and environmental, medical, and economic benefits. In a nutshell, these positive impacts of GE foods provide disease resistant crops with improved nutritional value by increasing the amount of essential amino acids into our diets and decreasing the amount of pesticide intake within our bodies because of decreased use of harmful chemicals on crops. They also claim that biotechnology can enhance food yields around the world and reduce nutritional deficiencies and allergens within areas of lower economic stance.

As discussed previously, Hart (2002) explains how the FDA had considered the unethical implications from the use of biotechnology in food products. However according to Hart (20020), James Maryanski of the FDA stated that,

> there are genes in humans and animals that are in plants. There is a gene that occurs in rice that also occurs in the human brain. Our current view is that these modifications will not result in foods that violate any ethical or religious considerations (p. 74).

That being said, how can the FDA justify ethical and religious implications for consumers? There are many moral and ethical debates found in popular media items, which will be discussed further on.

Results

This research question aims to identify how popular media items have influenced consumer behaviour in regards to purchasing GMO and organic food products whether they are labeled or not. The current research also set out to explore how consumers justify their purchasing behaviour when labeling measures are not enforced or provided. Finally it also set out to determine how popular media items influence consumer-purchasing behaviour. The research analyzed included 18 popular media items in the form of newspaper articles, websites, and documentaries, all of which focused in some way on public concerns related to GMO and non-organic practices and the stigmatization of the labeling practices implemented, or not, on such products. From a content analysis of these items, three main themes were identified which included: human health ethics, environmental concerns, and the necessity of labeling GM food products. These themes emerged from analysis of the popular media discourse and consequently the identification of topic clusters common to the popular media examined. Human-health ethics and human-related issues emerged as one of the most talked-about topics, which is relevant to the discourse of ethical considerations of GM food labeling. Within the context of human concerns, further themes were identified, notably those pertaining to human-health uncertainties, organic and conventional farmers' rights, and the safety of biotechnology and its adverse effects on future generations.

Human Concerns

The most common theme within the discourse of human-related concerns surrounds the ethics of human health. In numerous popular media items, controversy has risen in regards to the safety of GMOs within the food supply. Hail Merry-- a raw, vegan, and gluten-free snack brand-- states that most developed countries do not consider GMOs to be safe and over fifty countries worldwide, excluding Canada and the United States, have strict restrictions and bans on the production and sale of GMOs ("Natural, Organic, & Non-GMO Foods: Why it Matters to You!", n.d.). Likewise, the documentary titled "Seeds of Death: Unveiling the Lies of GMOs" written and produced by Gary Null and Richard Polonetsky (2012) discusses how the roundup herbicide used by the corporation Monsanto places safety concerns among consumers. Created and established by Monsanto, the roundup herbicide contains an active ingredient called glyphosate which was patented in 1964 as a 'broad spectrum chelator', rather than an herbicide (Null & Polonetsky, 2012). Seed companies like Monsanto have been granted permission to spray it directly onto crops preventing plants from accessing essential minerals. Glyphosate also destroys essential microorganisms in the soil which provide nutrients to the plants. Furthermore, it promotes pathogenic organisms which override the plants and create weaker vegetation and stronger disease. Null and Polonetsky's (2012) arguments insist that this practice leaves fewer nutrients for humans and can cause serious diseases among us as well. The main issue in regards to human health in this context is that numerous studies and popular media items have emphasized that GM vegetation is tolerant to large amounts of chemicals unlike conventional or organic vegetation. This allows crops to be sprayed with harmful herbicides and pesticides several times allowing toxins to accumulate in the plants, livestock, and inevitably in humans as well.

Other human health concerns discussed within popular media items was the potentiality of allergens, development of new diseases, nutritional problems, reproductive and immune system malfunctions, to name a few. These risks have led to physicians advising patients to avoid eating GMOs as part of their diet since GMOs can mimic certain allergens in humans having us believe that we are allergic to certain foods when really it is GMOs that causes the reactions inside our bodies (Smith, 2014). Aside from these health uncertainties consumers have also voiced their concerns about the FDA's process of testing such products for allergens and toxins before entering the market. David Knowles (2013a) in his New York Daily News article "GMO foes blast Scientific American editorial decrying labeling laws" explains how the FDA is not liable for testing whether or not these products are safe for the public. Rather, it is the individual company that is responsible. The companies can then decide if they want to report it to the FDA or not. Essentially, the FDA is not required to test or report GM products. Moreover, Null and Polonetsky (2012) discuss how the FDA is certain that GM seeds are no different then that of conventional seeds so they do not require labeling or testing and the public does not need to know. Furthermore, Smith (2014), a consumer advocate, reported that the FDA was instructed by the American White House to promote biotechnology. Monsanto's former attorney Michael Taylor was put in charge of FDA policy and later became Monsanto's chief lobbyist and has returned to FDA in charge of food policies (Null & Polonetsky, 2012). Being the corporation to declare PCBs, agent orange, and DDT to be safe, Monsanto assures the safety of GMOs in our food supply.

The second most prevalent theme in the discourse of human-related concerns lies within organic and conventional farmers' rights in regards to the protection of their crops from GM seeds. The issue of cross-pollination of plant species from a GM crop to a conventional or organic crop leaves both the organic and conventional farmers looking for justice against corporations and chemical companies such as Monsanto, DuPont, Dow, Syngenta, and Bayer who use GM seeds (Smith, 2014). In Canada alone, cross-pollination and contamination of crops has cost the government millions of dollars annually (Null & Polonetsky, 2012). Furthermore, for the first time ever in Canada, seed companies are launching a GM seed, alfalfa, which will likely invade non-GM crops (Gillis, 2014). Today, corporate GM crops account for approximately 90% of the American food supply and are expected to increase even more as GMOs become the most popular supplier of food (Null & Polonetsky, 2012). Currently, conventional and organic farmers have disappeared or are at risk for disappearing due to the cross-pollination and contamination of GM seeds from chemical corporations. Furthermore, Bloomberg (2014) reported that Monsanto has experienced rising sales (even more then what was expected by analysts) of the GE soybean and the roundup herbicide. The loss of traditional farms is also due, in part, to lawsuits from Monsanto where they have been able to sue farmers for "withholding" their seeds, even though it was Monsanto's seeds that contaminated the traditional crops (Null & Polonetsky, 2012). Inevitably, conventional and organic farmers are victims to this issue and are now forced to buy seeds from Monsanto because they cannot use their own. In response, Null and Polonetsky (2012) express how according to Monsanto, it is the farmer's responsibility to set up buffer zones around their property to avoid cross-contamination.

The safety of biotechnology and its adverse effects on future generations is the third human-related issue regarding GM and non-organic crops. As stated previously,

biotechnology is supported by authoritative structures like that of the American White House, which deems this form of technology as the superior food provider throughout the United States. Discussed as unsafe in many relevant popular media items, it is clear that the public strongly desires regulatory and safety practices within the FDA to ensure food safety for future generations. According to Null and Polonetsky (2012), the biotech industry is part of the pharmaceutical industry. This means that since pharmaceutical companies rely on your profit of pharmaceuticals, they do not want you to be healthy because they want you to purchase pharmaceuticals. In other words, the pharmaceutical industry is the biotech industry which support GMOs that end up in the food supply.

Aside from adverse health effects, Ken Roseboro (n.d.), interviewed scientist Belinda Martineau about modified genes in food products and how long-term exposure could affect future generations of people. Martineau explains how

> risks associated with the fact that genetic engineers have no control over where in a plant's DNA their gene will land and they often land in another gene, mutating that gene. Unexpected changes can occur in GM plants as a result of such unintended insertions– and other possible mutations.

This is problematic because the creation of mutations in plants, when consumed by humans, can alter the human gene pool as well. In other words, as we consume plants or livestock with modified genes, our genes will inevitably become modified and change permanently.

Environmental Concerns

Genetically modified crops have sparked controversial debate as to whether or not GM food products have a significant impact on the natural environment or not. A majority of media items analyzed for this research paper has emphasized the profound negative effects GMOs have had on the environment. In the context of environmental issues, the most prevalent concerns within popular media items include how GM crops will reduce biodiversity, create herbicide-tolerant crops spreading resistance to weeds, and lead to bio-safety concerns for the natural environment and livestock.

The reduction of biodiversity is a major concern discussed in popular media items. According to Smith (2014), the FDA is considering approving GM salmon into the food supply. For example, Null and Polonetsky (2012) discuss the implications of GM salmon, raising concerns such as their growth rate-- which is approximately double that of non-GM salmon-- and the potentiality of GM salmon escaping into the wild. If these salmon were to enter into natural ecosystems, with their growth rate and substantial eating habits, it is feared that these so-called 'franken-fish' could kill other species entirely changing the natural fluctuation of the ecosystem (Null & Polonetsky, 2012). Alongside GM salmon, Smith (2014) also discusses the FDA's potential approval and introduction of not only GM salmon, but also mosquitoes into Florida and countless other insect, plants, animals, fish, and bacteria throughout the United States, which would irreversibly contaminate the gene pool and interfere with natural selection. Like GM salmon, corn grown with biotechnology (BT)-- defined as the exploitation of biological processes for industrial and other purposes, especially GM food used in agriculture-- and other GM vegetation, according to Null and Polonetsky (2012) and Smith (2014), have negative effects within cropland. The introduction of these GM species has been linked to

the decline in monarch butterfly populations since BT corn and other GMOs contain built-in pesticides that create holes in the stomachs of insects, thus killing them. This inevitably is not only a problem for insect species, but also for numerous other organisms that rely on them as a food source. As a result, an intense reduction of species due to the 'knock-on effect' will be apparent as GM crops continue to expand. Evidence has also shown that livestock are also susceptible to illness or even death when grazing on BT crops. However, some livestock are even able to withstand larger quantities of GM-related products such as roundup-ready soybeans because they are given hormones and antibiotics, although overtime toxins accumulate within their bodies which creates further illnesses (Null & Polonetsky, 2012).

Media items also discuss the uncertainties expressed by the public regarding herbicide-tolerant crops spreading their resistance to weeds. The Just Label It website released an article, "Are GM Crops Making Farmers Lives Easier?" (2014) emphasizing the negative repercussions of using GE crops. It explains how with the increase of herbicides-- remember that GM vegetables are designed to withstand large amounts of chemicals-- 'superweeds' have been created that are also able to resist chemicals leaving farmers struggling to control weed populations within their crops. Null and Polonetsky (2012) similarly discuss how crops have started to become resistant to the roundup herbicide, which stays in the soil for months or even years and continues to promote diseases throughout crops. In the United States, Null and Polonetsky (2012) have also stated that GMOs have contributed to over forty plant diseases because of the overuse of Monsanto's roundup herbicide.

Bio-safety concerns regarding the natural environment and livestock are also discussed within popular media items. As mentioned previously in this paper, bio-safety management, as defined by Teng (2008) "is a generic term used to cover any aspect of safety issues associated with the potential or actual effects of GMOs on the ecosystem" (p. 239). The concerns pertaining to bio-safety management and regulation stem from the FDA's approval of GMOs within the food supply. Again, the FDA leaves the safety study up to the company who produces the food, meaning they leave it up to the corporation (e.g. Monsanto) which suggests GM crops are superior to conventional and organic crops. Roseboro (n.d.) explains how the FDA allowed a seed company to place their GM tomatoes on the market although in thirty-percent of the tomato plants, they contained extra genes (such as antibiotic resistance genes) in addition to those that were to be inserted. The FDA, according to Null and Polonetsky (2012), has set a policy that allowed GMOs on the market which has created unprecedented risk for human and the natural environment.

Labeling Concerns

Along with human and environmental-related concerns of GMOs in the food supply, labeling stemming from both of these is a third uncertainty commonly expressed in popular media discourse. In multiple popular media items labeling is presented in various ways because it is a consumers' right to know, it must also not mislead consumers (i.e. having the consumer believe it is 100 percent GM- free or organic when it may not be the case). However, GM and biotechnological advocates believe labeling to be unnecessary, costly and an unlawful practice.

The labeling of conventional, organic, and especially GM foods are critical in order for the public to make conscientious food decisions. This has become a growing issue of contention as GMOs have become a heated topic of skepticism throughout the media. As one of the first national grocery chains to set a deadline for full GMO transparency, Whole Foods Market aims to label all GM products in their stores throughout Canada and the United States by 2018 (Lowery, 2014). Customers have consistently requested GMOs to be labeled to allow them the right to know what they are buying within stores. Currently within Whole Food Market stores, products contain non-GMO or organic labels so that customers can avoid GM products. Hank Shultz (2014) similarly discusses how labeling GMO products will propel the organic food industry since organic products assure no GM elements. Organic food labeling indirectly lets customers know that such produce are grown in safe soil with no modifications and are processed with specific requirements (Paul, Kemp & Segal, 2013). However, the organic label can be misleading.

Throughout the United States, concerned consumers have fought for their right to know by encouraging legislation that provides labels for food that have been genetically engineered (Knowles, 2013a). Several media items explain how the GM label would provide consumers a better understanding of what they are buying and how the product was produced. However, even without labels directly stating whether or not the product is GM, Paul et al. (2013) provides the public with alternative information pertaining to GM, conventional, and organic labels. This includes knowing the products 'price lookup' or PLU, which is the sticky label containing a set of numbers. Conventional, organic, and GMOs each contain four or five digit codes that start with specific numbers that tells the customer how the food is grown. Although not a certified label, it is an alternative way to allow the customer the right to know about the product they intend to purchase.

Several media items also discuss the differences between non-GMO and organic produce. Dan Charles (2014) explains how the movement towards the labeling of non-GM food products has steered consumers away from purchasing organic foods because of cheaper prices. Non-GMO food products, explains Charles (2014) are essentially conventional food products. The time and money being put into organic produce on the other hand, leaves farmers wanting higher profits because the process is more costly. Many retailers such as Whole Foods Market are using the non-GMO label to attract customers to cheaper produce since the non-GMO label has been considered more important over the organic label. According to Shultz (2014), more then 5,000 products contain the GMO-free label in the United States, being one of the fastest growing brands to hit the market.

Misleading non-GM and organic labels have also been a concern among the public. Organic products have zero tolerance to GMOs, however there is no required testing on organic produce ("Natural, Organic & non-GMO", 2012). What is concerning is the fact that due to cross-pollination and contamination, GM seeds will inevitably contaminate non-GM and organic crops (Null & Polonetsky, 2012). Furthermore, Null and Polonetsky (2012) explain how organic produce may be sold, labeled, and presented as organic, even with the inadvertent presence of GMOs. Without required testing, how can we assure organic and non-GM produce is what it claims to be?

Media items have also presented viewpoints from GM and BT advocates claiming that labeling of GM products is an unnecessary, costly and unlawful practice. In response,

Null and Polonetsky (2012) explain how Monsanto does not believe their GM seeds to be any different than conventional seeds. However, the patent office in Washington D.C claims that seeds do not need to be patented since there is no difference between them and natural products although, conversely, Monsanto would argue that the seeds are in fact very different because they have invented something brand new and is radically different (Null & Polonetsky, 2012). In that case, what side does Monsanto stand on? Also, as discussed previously, many advocates of mandatory labeling practices express that there has not been enough long-term study of health and environmental effects from GE foods (Knowles, 2013b). Contrary to this, Monsanto has claimed that such research does not need to be conducted because there have been several studies that assure no health risks are associated (Knowles, 2013b).

Discussion

Human health uncertainty among the public has brought controversy in regards to the consumption of GM food. Furthermore, skeptical attitudes from scientists and scholars surrounding the integrity of GM products and its effects on the environment were also examined. The literature review also discussed the necessity of non-organic and GMO food product labels which, as emphasized by consumers, requires intensive regulatory practices and safety procedures in order to be proven as 'substantially equivalent' or better than those of conventional food products. As such, the content analysis broke down and related the chosen 18 popular media items to my literature review, and thematically organized them into units of data.

Based on the scholarly work and the data gathered from popular media items, it is clear that there are many common trends and similarities between what scholars are saying, and what the media tells the public. Popular media items are a major source of information for the public. A majority of North Americans receive information via the media, which is why it is so important to analyze the media's influence on consumers and their behaviour on such matter.

The literature and the popular media data show how the overall public attitudes displayed skepticism towards the integrity of GM food products, and that this skepticism has caused public anxiety and concerns for the health of humans and the environment. Both scholarly works and media items have emphasized how necessary it is for consumers to have a choice in regards to what they are purchasing in supermarkets. People do not want to be consuming food that they do not trust or are uncertain about. Along with consumers, according to Harlander (2002), scientists too are struggling with how to justify what is safe to consume, how to determine if a product contributes to environmentally degradation, and whether or not labeling practices of foods that are transgenic and organic are truthful.

Another common trend expressed through media items and scholarly works involved the potential health hazards associated with GM food products. Both media items and scholarly articles were sufficient in providing information, although not 100 percent certain, with the potentiality of human health hazards associated with GM food products. Again, this relates to consumer and scientist skepticism of unjust health concerns including allergens, development of new diseases, nutritional problems, reproductive and immune system malfunctions, and many more.

The necessity of GM food products requiring 'substantial equivalence' to conventional counterparts was also discussed. Conventional agriculture poses risks towards environmental and human health as harmful chemicals are used in the process of this form of agriculture. That being said since BT and GM agricultural produce can withstand larger amounts of harmful chemicals, more can be applied which accumulates in the soil, vegetation, and consumers. This would not be 'substantially equivalent' to conventional farming because more harmful chemicals are accumulating in the produce. However, rapid technological innovations such as conventional agricultural practices have contributed to numerous environmental effects due to considerable amounts of environmental/resource degradation and chemical residue from pesticides, herbicides, and fungicides. This would be the only similarity, or 'substantially equivalent' attribute that GM and conventional products share. The media and scholars emphasize the unjust practices of both biotechnological and conventional crops, urging for consumers to be more knowledgeable of agricultural practices and the effects and impacts on organic practices, as well as the irreversible changes to human and environmental health.

Another commonality shared between the literature and media items highlights the fact that GM food products do not go through clear/strict regulation procedures. Although there have been recent studies conducted to determine GE food safety towards human health and the environment, these studies and tests have either been too short for significant long-term results, or the FDA deems GM food as 'substantially equivalent' which do not need further testing or labeling. Both the scholarly work and media items had emphasized that labeling does not guarantee that the product is one hundred percent GMO free and/or organic. The issue of mislabeling a product is due to cross-contamination of GM to non-GM and organic crops, and also labeling used as a market scam to increase product revenue. For instance, as discussed previously in this paper, cross-pollination of GM crops to non-GM crops is inevitable. As long as the crop is certified organic, the voluntary labeling can continue. Also, the GMO-free labels may be voluntarily placed onto food products to ensure the consumer that no genetic modifications are within the product. Consumers are more drawn into purchasing products with the GMO-free label because they think it is better for themselves and the environment. However, unless specified as organic, products labeled as GMO-free are provided by the individual company within conventional agricultural.

What did not appear in popular media items that were discussed in scholarly work included issues pertaining to safety regulations and labeling criteria that dealt with international trade. The media items examined were American and Canadian that discussed the implications of only cross-contamination of GM seeds from the United States into Canada by means of natural processes such as wind, insects, water, etc. There was no information explaining the criteria of international shipping to and from Canada and how this creates issues surrounding the United States FDAs' approval and Canadian standards. These standards within Canada require very low threshold values of GE traits within food products since this contamination has been recognized as inevitable. In comparison, products that were labeled as GMO-free within the United States in fact contained a considerable amount of GM corn or soy (Harlander, 2002). This brings us back to the issue of mislabeling and distrust and discontent expressed throughout the public.

There was also very little information within media items that expressed positive correlations between GM foods and human and environmental benefits. Only in the scholarly work was this mentioned. Lan (2006) expressed the general lack of knowledge consumers had towards GM food products, and that many believed that such technology can reduce hunger and increase profit throughout underdeveloped areas of China. This perspective considerably differed from the perspective of North Americans, due to different levels of economic wealth, which has a significant impact on consumer attitudes and behaviour. Pence (2002) also argued that GM crops will eradicate world hunger. Again, as stated previously in this paper, land acquisition in today's developing countries require extensive land usage, and increasing crop yields of GM modified rice will serve to eradicate world hunger as approximately half of the world's population relies on the availability of rice (Pence, 2002).

Overall, the most obvious themes within popular media items and scholarly works included concerns in regards to human and environmental health, and labeling practices and whether or not they are legitimate or misleading. However, the scholarly articles examined discussed more economic difficulties and pressures of implementing stricter regulations and safety testing before market approval, whereas media items discussed concerns in relation to human and environmental safety.

The public recognizes that there needs to be better testing prior to market approval, however, they question why it is necessary to implement bio-safety management, biotechnical research, and other forms of safety protocol to ensure GM food products safe for consumers. The fact that such food needs to go through such procedures implies indirectly that this form of technology comes with uncertainties which leaves room for debate between biotechnological advocates and GMO skeptics, and the distrust and uncertainties displayed by the public.

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Wind Energy Policy in Newfoundland and Labrador
Harnessing North America's Greatest Energy Resource: A SWOT Analysis and Policy Recommendations

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Despite having the strongest wind energy resources in North America, Newfoundland and Labrador is currently ranked 3rd last amongst Canada's provinces and territories in installed wind energy capacity. This analysis is designed to examine wind energy policy in Newfoundland and Labrador. The paper starts with a consideration of why it is imperative for the province to develop locally available, renewable sources of energy – economic and theoretical arguments are taken into consideration. The main component of this paper considers the strengths, weaknesses, opportunities, and threats of wind energy policy in the province. Based on the SWOT analysis of wind energy policy in the province, four key policy recommendations are provided which would allow the province to capitalize on its tremendous wind resources.

1.1: Newfoundland and Labrador – An Energy Powerhouse

The energy sector is a very important industry throughout Newfoundland and Labrador. The energy sector creates thousands of direct and spinoff jobs in energy-related industries. The sector generates significant fiscal benefits which are shared by all Newfoundlanders and Labradorians. The province's energy sector accounts for more exports than any other sector, and is the single largest component of gross domestic product (Government of Newfoundland and Labrador, 2007).

Newfoundland and Labrador has massive amounts of energy resources. The province has the ability to meet all of its own energy needs and is able to provide sufficient energy to other jurisdictions. The province's total developed clean, renewable energy generation plus additional potential resources amounts to 18000 megawatts (MW). The Province only uses 2400MW to meet its own needs (Government of Newfoundland and Labrador, 2007). The province's total oil and gas resources exceed eight billion barrels of oil, and 70 trillion cubic feet of natural gas (Government of Newfoundland and Labrador, 2007). The province is the single largest producer of electricity and one of the largest producers of petroleum in the world, on a per capita basis (Government of Newfoundland and Labrador, 2007). Newfoundland and Labrador is truly one of Canada's energy powerhouses – In 2007, producing almost 45% of Canada's conventional light crude, and 12% of the country's hydroelectricity (Government of Newfoundland and Labrador, 2007).

Newfoundland and Labrador ranks third last among Canadian provinces, with an installed wind capacity of only 51.7 MW. The province is only above the Northwest Territories (9.2 MW) and Yukon (0.81MW) (Canadian Wind Energy Association, 2013). Despite the massive benefits the province's energy sector has provided for its people, this paper will demonstrate how the province has missed a major opportunity by not developing its wind energy resources.

1.2: Research Methodology

In order to evaluate Newfoundland and Labrador's failure in developing its wind energy resources, two different research methods will be used. The first section of this paper (2.1: Why Should We Green our Energy Sector) will rely on a literature review – a survey of important articles, books, and other sources pertaining to this topic. This review of professional literature will help to contextualize the study. This literature review will provide readers with the necessary background to understand following sections.

The main component of this study (3.0: An Evaluation of Wind Energy Policy in Newfoundland and Labrador) will rely on a SWOT Analysis. A SWOT Analysis can be defined as "a technique for focusing an individual's or group's attention on strengths, weaknesses, opportunities and threats. It is useful particularly because strengths and weaknesses can be the cause of potential future risks – both opportunities and/or threats" (Murray-Webster, 2010, p.88).

The final section of this study (4.1: Policy Recommendations for the Development of Wind Energy) will also feature a literature review. This section of the paper will be included as a conclusion; laying out what the province must do in order to benefit from its wind energy resources.

2.1: Why Should We Green our Energy Sector?

The International Energy Agency (IEA) defines renewable energy as the type of energy which

> is derived from natural processes that are replenished constantly. In its various forms, it derives directly or indirectly from the sun, or from heat generated deep within the earth. Included in the definition is energy generated from solar, wind, biomass, geothermal, hydropower and ocean resources, and biofuels and hydrogen derived from renewable resources.

Before entering the main analysis of this report, a discussion of why we must move towards a green economy, particularly why we must green our energy sector is required.

The IEA estimates that primary energy demand will continue to grow at an average of 1.4% per year until 2035 without any major policy changes (UNEP, 2011). Energy demand will continue to grow against generally increasing fossil fuel prices. The four major challenges that greening our energy sector can address include 1) concerns about energy security, 2) combating climate change, 3) reducing pollution and public health hazards, and 4) addressing energy poverty.

Increasing energy demand and increasing fossil fuel prices have led to concerns in regards to the affordability and accessibility of energy. This is particularly relevant for low-income countries, but is also true for developed economies. A high dependence on a relatively limited range of suppliers has led to an increased vulnerability of national energy supplies. Increased energy supplies will be provided by the Organization for Petroleum Exporting Countries (OPEC). OPEC's share of the world oil market is predicted to rise from 44% in 2008 to 52% in 2030, well above its historical peak in 1972 (UNEP, 2011). Increased supplies of natural gas will be provided by Russia, Iran, and Qatar, this would increase the world's economy's energy dependency on these countries (UNEP, 2011). For jurisdictions which rely on massive amounts of imported oil, investing in locally available and abundant renewable resources would decrease dependency on these countries.

The Intergovernmental Panel on Climate Change (IPCC) has highlighted the importance of mitigating future anthropogenic climate change and adapting to changes that occur. Even if major policy changes were introduced today, damage from previous human emissions will take place, and the damage will be even greater if no action is taken. The United Nations Framework Convention on Climate Change (UNFCC) estimates global adaption costs at US $49-171 billion by 2030 (UNEP, 2011). The IPCC and IEA estimate that in order to limit global warming of 2 degrees Celsius, the atmospheric concentration of carbon must remain below 450ppm – this would require a peak of global emissions in 2015, with a 50% cut in emissions below 2005 levels (UNEP, 2011). In 2008, the Group of Eight (G8) – representing leaders of the word's eight most industrialized countries – committed to cut GHG emissions by 80% by 2050, in order to contribute to the global reduction of 50%. Shifting from fossil fuels to renewable resources will lead to a significant reduction in emissions. In order to reduce emissions to a point that will maintain the target of 450ppm by 2050, renewable resources will have to account for at least 27% of global energy supplies (UNEP, 2011). While Canada is responsible for only 1.8% of global GHG emissions, the country has experienced some of the highest GHG growth rates in the world. Between 1990 and 2005, GHGs grew more than the global average with an increase of 26.2% (Government of Newfoundland and Labrador, 2013). Newfoundland and Labrador's GHG emissions are approximately 10.5MT, accounting for about 1.5% of Canada's total emissions. About half of the province's GHG emissions come from energy and energy intensive sectors, including oil extraction and mining, mining operations, pulp and paper and electricity generation. The transportation sector is also a major source of GHG emissions in the province, accounting for about one-third of emissions (Government of Newfoundland and Labrador, 2013).

Our current systems of energy production have significant impacts on our health and ecosystems. There are high indirect costs associated energy, and solar may alleviate rural energy poverty and displace costly diesel generations. Off-grid and mini-grid solutions would also avoid the generation of greenhouse gases (GHG), lessening remote communities' dependency on fuel imports. Energy poverty is normally a term associated with less developed countries, but due to aging infrastructure, and the existence of remote communities within more developed countries, the global north is not exempt from these problems; case study 2.1 refers specifically to a Newfoundland and Labrador experience. with pollution from burning fossil fuels. The release of black carbon particles (caused by the incomplete combustion of fossil fuels) and other air pollutants such as sulfur, nitrogen oxide, and other heavy metals have negative effects on public health. For example, indoor air pollution from the burning of solid fuel accounted for 2.7% of the global disease burden in 2000 (UNEP, 2011). Burning fossil fuels in the US costs the country $120 billion a year, mostly due to premature deaths from air pollution (NRC, 2010). The IEA estimates that worldwide air pollution cost more than US $254 billion in 2005, and this is expected to triple by 2030 (IIASA 2009, IEA 2009a). Newfoundland and Labrador is a relatively high emitter of sulfur dioxide (per capita). Ontario, for instance, emits about half the SO2 per capita that our province does. The single largest source of sulphur dioxide emissions in the province is the Holyrood Thermal Generating Station (Government of Newfoundland and Labrador, n.d.). Burning fossil fuels for energy in the province also emits mercury. Renewable energy can entirely avoid, or at least mitigate the public health risks from the mining, production, and combustion of fossil fuels. The use of fossil fuels and traditional fuels impacts global biodiversity and ecosystems through deforestation, decreased water quality and availability, acidification of water bodies, and increased introduction of hazardous substances into the

biosphere (GNESD, 2007, Modi et al, 2006). All of these impacts reduce the planets natural capabilities to respond to climate change.

Reliable and modern energy services are required to reduce energy poverty, which in turn leads to improvements in education and health. Energy poverty is a lack of access to modern energy services. In remote places, off grid and mini-grid systems may be more effective than expanding or updating existing systems. Renewable off-grid solutions such as hydro, wind, bio-

Case Study 2.1: Energy Poverty in Newfoundland

During the beginning of January 2014, the province of Newfoundland and Labrador experienced major difficulties with their power supply distribution, as well as widespread power outages across the entire island portion of the province generated by low temperatures and harsh winter conditions. A preliminary report by the province's Public Utilities Board indicated that record demand on the province's power grid leading to the power outages and reductions in power availability due to problems with several of Newfoundland Hydro's generating units contributed to the problem. The island wide power system collapsed twice in a single weekend, once caused by a fire at a substation in the town of Sunnyside, and once caused by a blown breaker in a switchyard at the troubled generating plant in Holyrood.

The massive energy collapse led to hundreds of thousands of people shivering in dark, frozen homes (CBC News, 2014). Before and after the widespread outages, Newfoundland communities were subject to rolling power blackouts for hours at a time in order to conserve energy. All public schools in the province were closed for a minimum of three days (CBC News, 2014).

This short case study shows that a lack of access to reliable energy is not only a problem in less developed countries; it is a real threat facing jurisdictions in the developed world as well. Newfoundlanders were left in the cold for days on end, and their access to vital services and education were limited. Off-grid and mini-grid renewable energy sources could have mitigated or prevented the wide spread energy collapse experienced in Newfoundland.

2.2: Economic Arguments in Support of Greening our Energy Sector

Throughout the last few decades, renewable energy technologies have developed quickly, bringing their price down to where they can compete with fossil fuel technologies. The IPCC has concluded that the technical potential of renewable energy technologies will be able to meet global demand for these technologies (UNEP, 2011). For example, onshore applications of wind energy are technically mature, while offshore wind energy is in the diffusion phase, already reaching its mature stage in many places. Overall, the IPCC demonstrates renewable energy technologies are increasingly competitive with fossil fuel technologies (UNEP, 2011). The true cost of continuing to use conventional energy sources is distorted by not counting externalities from their use and the perverse impacts of subsidies.

The use of fossil fuel energy sources produces economic externalities which include air pollution, the cost of climate change adaption, and ocean acidification from carbon dioxide emissions. Failing to internalize the externalities of fossil fuel use distorts the costs and returns of investing in renewable energy technologies, in comparison to fossil fuels. A recent survey by the World Health Organization (WHO) found that external environmental risks account for up to 10% of the global health and disease burden, half of which were a direct result of fossil fuel use

(WHO, 2009). These are costs which must be paid, but are not accounted for in the price of a barrel of oil. Scholars in the US have shown that the true cost of energy production from fossil fuels (including externalities) is US$0.27 per kilowatt hour (p/kwh), much higher than the average market price of US$0.09 p/kwh (Epstein et al, 2011). US government subsidies to fossil fuel industries for coal production in the same year were approximately US$0.27 p/kwh (ELI, 2009). Climate-change externalities from fossil fuels directly affect consumers through change of weather patterns, loss of arable land or agricultural yield, water scarcity, and diminished ecosystems (NRC, 2010). Generally, producing energy from fossil fuel plants has higher externalities than renewable energy technologies. Various renewable energy technologies would already be cost-competitive with fossil fuel technologies if their externalities were internalized (***Case Study 2.2).*** Annual government subsidies of approximately US$500-700 billion per year for conventional energy sources (mostly fossil fuels) create an uneven playing field for the adoption of renewable energy technologies (UNEP, 2011). For comparison, the IEA estimates government support for renewable energy technologies and biofuels was about US$59 billion in 2009 (IEA, 2010D).

Case Study 2.2: Fossil Fuel Externalities and Subsidies in Newfoundland

Newfoundland's Holyrood thermal generating station supplies on average between 15-25% of the island's electricity, and as much as 30% during peak demand (Department of Natural Resources, 2012a). The plant burns up to eighteen thousand barrels of oil per day, and its costs of operating have risen drastically with increased world fuel prices, which in turn have led to rate increases for customers. In 2011, Holyrood generating station cost ratepayers $135 million, in 2017 the cost to generate electricity at the plant will rise to $324 million (Department of Natural Resources, 2012a). The Holyrood facility is now 40 years old. Continued use of the facility will translate into escalating maintenance costs, massive capital investments and upgrades for emissions control equipment, and continued dependence on fossil fuel generation. These costs will ultimately be covered by ratepayers, and potential subsidies from taxpayers.

Retiring the plant now would address the environmental and health concerns of residents in surrounding communities due to the release of GHG and fossil fuels. From 2000 to 2010, the plant emitted 1.1 million tonnes of GHG, and an annual average of 11,610 tonnes of sulfur dioxide (Department of Natural Resources, 2012a). Retiring the plant now would avoid the costs of dealing with any additional pollutants emitted to the atmosphere.

Many remote communities throughout Newfoundland and Labrador are not connected to the provinces main energy grid. These small communities depend on small diesel-generating plants. The costs of these isolated systems are currently being subsidized to the order of 75% by residential ratepayers in the province (Government of Newfoundland and Labrador, 2012). Residential customers in isolated communities throughout Labrador continue to benefit from an annual government subsidy of two million dollars through the Northern Strategic Plan (Newfoundland Hydro, 2013). By switching to renewable sources of energy, the Government of Newfoundland and Labrador could save considerable amounts of money by avoiding fossil fuel externalities and eliminating subsidies for small diesel-generating plants. This money could be used to invest in renewable energy technology.

The employment prospects in the renewable energy sector are another important consideration in greening our energy sector globally. Employment in the renewable energy sector has become substantial globally, directly and indirectly accounting for 3.5 million jobs in 2010 (UNEP, 2011). Wind energy generation in particular has undergone rapid growth, with jobs more than doubling from 235,000 in 2005 to 550,000 in 2009 (WWEA, 2010). The Green Jobs Report estimated that with strong policy support, up to 2.1 million people could be employed in the wind energy sector by 2030 (UNEP & ILO & IOE & ITUC, 2008). Jobs in renewable energy are safer in terms of potential health risks when compared to fossil fuels, leading to longer employment periods and increased human capital (UNEP, 2011). The renewable energy sector creates more jobs than conventional sources; a recent study found that the renewable energy sector generates 1.8 – 4 times more jobs per megawatt (MW) installed than conventional sources (Sastresa et al, 2010).

2.3: Why Now Is the Time to Invest in Our Renewable Energy Sector

The IEA estimates that every year of delay in adjusting our energy sector to the 450ppm trajectory will add approximately US$500 billion to the global costs of mitigating climate change (IEA, 2009a). Not only are the costs of mitigating climate change raising drastically, but the price of oil is expected to increase exponentially. Peak oil can be defined as the point when the global production of oil reaches a maximum and then prices begin to rise as production gradually declines. Under a business as usual scenario (BAU), conventional oil will peak following the year 2035 (UNEP, 2011). Peak oil has already taken place 30 years ago; not "peak-production", but "peak-discovery". Oil has to be found before it is produced; it is clear that the peak of discovery in the 1960s will inevitably lead to peak production (Bardi, 2009).

Prices are rising dramatically and global emissions are continuing to grow. Under the BAU scenario, energy related CO2 emissions will rise from 28 gigatonnnes (GT) in 2006, to 42 GT in 2030, and to 50 GT in 2050 (UNEP, 2011). Under a green investment scenario, global emissions would be approximately 60% lower in 2050 as compared to the BAU scenario (UNEP, 2011).

Under the BAU scenario, employment in the energy sector is predicted to fall from 19 million in 2010 to 18.6 million in 2050, due to increased labour productivity in fossil fuel extraction and processing (UNEP, 2011). Under a green investment scenario, there is a projected energy sector employment increase of 21% over the comparable BAU scenario (UNEP, 2011).

The global community, national, regional and local governments are facing some major energy challenges including threats to national energy security, adverse effects of climate change, and continued public health impacts. These problems associated with the use of fossil fuels will continue to exacerbate as population and income continue to rise. Shifting from fossil fuels to renewable energy technologies will play a critical role in greening our energy sector. Renewable energy technologies have become increasingly cost effective in recent decades, and many renewable energy technologies are already competitive with fossil fuel alternatives. Erasing subsidies for fossil fuels and internalizing the costs of health impacts and environmental destruction will further aid in the development of renewable energy technologies. Greening our energy sector will lessen health and environmental impacts, and ensure the basis for long term development (UNEP, 2011). This will increase national energy security, reduce CO2 emissions, and create new employment opportunities. Newfoundland and Labrador is uniquely positioned to

start investing in renewable energy technologies and infrastructure due to the high revenue from oil in the last decade, if part of this revenue is allocated to renewable energy (Hartwick, 1997).

3.0: An Introduction to Wind Energy

Wind is a form of solar energy. Winds are caused by uneven heating of the atmosphere by the sun, irregularities of earth's surface, and the rotation of the earth. Wind flow patterns are affected by the earth's terrain, bodies of water, and vegetative cover (US Department of The Interior, n.d.). Wind flow can be harvested by modern wind turbines and can be used to generate electricity. Wind is a free renewable resource. This means that no matter how much wind energy we harvest today, the same supply will still be available in the future. Wind energy is a source of clean, non-polluting energy. Unlike traditional fossil-fuel plants, wind plants emit no air-pollutants or GHG. In addition to the environmental benefits, wind energy creates substantial economic benefits through increased investment and job creation, lease income for landowners and a new tax base for municipal governments (Newfoundland and Labrador Hyrdro, n.d)

Wind energy is among the fastest growing major sources of electricity around the world. In 2012, installed capacity of wind energy grew by nearly 20 percent in Canada, representing over $2.5 billion in investment and creating 10, 500 jobs (Canadian Wind Energy Association, n.d.) Canada's current installed capacity is over 6,500MW, generating enough electricity to power the equivalent of two million average Canadian homes (Canadian Wind Energy Association, n.d.). Every Canadian province is now benefitting from clean wind energy to some extent.

Modern wind turbines have a typical life span of 20-25 years. Modern wind turbines can withstand winds as high as 180/kmh and temperatures as low as -40 degrees Celsius (Newfoundland and Labrador Hyrdro, n.d). A single large scale wind turbine can provide sufficient energy for hundreds of homes, while many turbines clustered together in a wind farm can power thousands of homes and businesses.

Wind turbines are a promising source of energy, but as with any energy source drawbacks do exist. The manufacturing and installation of wind turbines requires heavy upfront investments - in both commercial and residential applications. Wind is an intermittent source of energy and is not suited to meet the base energy demand unless some other form of energy storage is utilized (e.g. batteries, pumped hydro). Wind turbines can be a threat to wildlife, they produce noise which is regularly reported as a problem by neighboring homes, and the aesthetics of wind turbines is a concern for some people (Maehlum, 2013).

Newfoundland and Labrador has significant amounts of wind resources available to harvest. This section of the paper will consider the strengths, weakness, opportunities, and threats of wind energy policy in Newfoundland and Labrador.

3.1: An Evaluation of Wind Energy Policy in Newfoundland and Labrador: Policy Actions

Newfoundland and Labrador's main energy policy was released in 2007; the document is entitled Focusing Our Energy, and provides a summary of the province's energy strategy. The document outlines four key focus areas including oil and natural gas, electricity, environment, and economics – with the latter two categories underlying the development of the province's energy resources. The document succinctly outlines the province's policy actions in regards to wind energy. These include:

- Adopt a new policy on Crown Lands issuance for wind power that only the Energy Corporation, or a company selected by it, will be able to obtain a Crown lease for a wind power development.
- Work with Aboriginal governments and groups in areas where potential wind developments are subject to an Aboriginal treaty or a land claim.
- Pursue opportunities for locating manufacturing and fabrication of wind turbine components such as towers, tower bases, and turbine blades in the province (Government of Newfoundland and Labrador, 2007).

3.1.2: Electricity Sector Management Structure

In Newfoundland and Labrador, the generation and distribution of electricity is provided by two utilities, Newfoundland Power and Newfoundland and Labrador Hydro. Together, the two utilities serve about 280, 000 households (Department of Natural Resources, 2013). The majority of the customers are served by the island interconnected system. In Labrador, customers on the Labrador interconnected system are served by Hyrdro with power from the 5428 MW Churchill Falls Hydroelectric Generating Station (Department of Natural Resources, 2013). Customers in 21 isolated systems in communities throughout Newfoundland and Labrador receive their power from diesel generators operated by Hydro.

Newfoundland Power, an investor-owned utility, and subsidiary of Fortis Inc., is the primary distributor of electricity on the island portion of the province. Newfoundland and Labrador Hydro supplies about 92 per cent of its energy requirements and Newfoundland Power provides the remainder from 23 small hydroelectric generating plants (Department of Natural Resources, 2013).

Newfoundland and Labrador Hydro is a provincial Crown corporation, with a mandate to generate and transmit electricity in the province, and to provide distribution and retail services to customers in Labrador and in island portions of the province which are not served by Newfoundland Power. The Crown corporation was established by the Power Commission by an act of the provincial legislature in 1954 and was incorporated in 1975 (Department of Natural Resources, 2013).

In 2007, the Government established an energy corporation, now entitled Nalcor Energy. Nalcor became the parent company of Newfoundland and Labrador Hydro. Nalcor has expanded into the broader energy sector in recent years, including oil and gas, wind energy, and research and development (Department of Natural Resources, 2013).

3.2.1: Strengths of Wind Energy Policy in Newfoundland and Labrador: Wind Farms Reducing Dependency on Fossil Fuels

In 2006, Newfoundland and Labrador Hydro (Hydro) took the first steps required to integrate wind energy into the province's energy system. Today there are two wind farms operating within the province, generating up to 54MW of energy (Newfoundland and Labrador Hyrdro, n.d.). In 2007, Hydro secured the power purchase agreements for 54MW of wind energy on the island – this included one 27MW project in St. Lawrence, and one 27MW project in Fermeuse. On average when compared to the cost of producing energy at the province's Holyrood Thermal

Generating Station, the projects will save consumers up to eight million dollars per year over the 20 year length of the contract (Newfoundland and Labrador Hydro, n.d.).

The St. Lawrence Wind Farm was brought to life in 2007, when Hydro signed a 20 year power purchase agreement with Newind Group. This project is located one kilometer northeast of the community of St. Lawrence on the Burin Peninsula. The project consists of nine, three MW wind turbines which began supplying power to the grid in October, 2008. The Fermeuse wind project began in 2008, when Hydro signed a 20 year power purchase agreement with Skypower Corporation, an independent renewable energy developer in Canada. This 27MW project is located in the community of Fermeuse on the Avalon Peninsula. The project began feeding the grid in April, 2009 (Newfoundland and Labrador Hyrdro, n.d).

In 2010, Hydro purchased 183, 252 megawatt hours of wind energy from the province's two wind farms. This is enough energy to power 12, 300 homes or equivalent to burning 290, 000 barrels of oil at Holyrood. By using wind power, the province experienced a reduction of 143 000 tonnes of GHG emissions (Newfoundland and Labrador Hyrdro, n.d.b). This demonstrates how every single additional megawatt hour of wind energy produced in the province is helping to reduce its impact from burning fossil fuels and reduces costs to ratepayers.

3.2.2: State-of-the-art Research in the Province

Hydro's parent company, Nalcor Energy, is currently in the process of commissioning 300 kilowatts of wind energy as part of a wind-hydrogen-diesel energy project in the community of Ramea, on the southwest coast of Newfoundland (Newfoundland and Labrador Hyrdro, n.d.a). This project has the potential to have a huge impact – Ramea has averaged 3300 tonnes of GHG emissions every year since 2000 from burning diesel fuel (Nalcor Energy, 2013).

When completed, this state-of-the-art project, which is unique to Canada, will permit a shutting down of all diesel generators on Ramea Island during periods of low energy demand (Natural Resources Canada, 2013). This project will allow the provinces power utility to provide clean wind power to the community, either directly from the turbines, or from stored hydrogen, created by using excess wind generated electricity. Ramea Island has an isolated power system, and when the communities wind turbines do not provide sufficient energy, stored hydrogen powers generators which will provide electricity to the community.

This project is being led by Newfoundland and Labrador Hydro, with support from the Atlantic Canada Opportunities Agency, the Government of Newfoundland and Labrador, and Natural Resources Canada. Additional partners include Memorial University of Newfoundland, and the University of New Brunswick (Natural Resources Canada, 2013). The project was commissioned in 2009, and is now undergoing further performance monitoring, and research and development.

Nalcor Energy's Wind Development Strategy indicates plans to use similar systems to reduce and ultimately replace diesel fuel in the province's isolated diesel systems. Currently the province has 21 of these systems, which consume 15 million litres of diesel annually (Nalcor Energy, 2010). The Wind Development Strategy is currently only at the stage of research and development, but has the potential to eventually replace diesel with zero-emission power throughout the province's isolated diesel systems.

3.2.3: Newfoundland and Labrador Green Fund

One successful wind energy policy action in the province is the Newfoundland and Labrador Green Fund. This is a $25 million fund designed to support projects that provide a real net reduction in GHGs. It is a combination of federal and provincial funds – including $23 million from the federal government and $2 million from the provincial government (Government of Newfoundland and Labrador, n.d.). To date $21 million in projects have been approved, and several applications are in various stages of the assessment process. The provincial government estimates that total GHG reductions for the $25 million Green Fund could be as much as 200, 000 tonnes per year (Government of Newfoundland and Labrador, n.d).

The Newfoundland and Labrador Green Fund has had a positive effect by supporting a number of small wind energy developments in the province. One project was the installation of a combined solar and wind power generating and storage system for Flowers River Lodge in Labrador. This project has the potential to reduce GHG emissions by 52 tonnes per year. Another project involved the installation of a wind powered energy system to replace diesel generated electricity for Brother Brennan Environmental Education Centre in Deer Lake. This project has the potential to reduce GHG emissions by 20 tonnes per year (Government of Newfoundland and Labrador, n.d.).

3.2.4: Breaking New Ground: Manufacturing Potential in Corner Brook, Newfoundland.

As mentioned in section 3.1, one of three policy actions outlined in Newfoundland and Labrador's energy strategy is to pursue opportunities for locating manufacturing and fabrication of wind turbine components such as towers, tower bases, and turbine blades in the province (Government of Newfoundland and Labrador, 2007). This policy action has seen some early success. Beothuk Energy, a St. John's based company, has formally announced plans to set up a manufacturing facility at Corner Brook Port. When completed, the facility will manufacture gravity-based-structures for offshore wind turbines. The construction of the first structures is expected to take place in 2015 (The Western Star, 2013). The company has identified Corner Brook as a prime location for this facility due to its proximity to energy markets, and Corner Brook Ports access to tide water, which will reduce the costs needed to ship the structures to wind farms. The company is predicting the creation of 600 jobs within the facility. In addition to the manufacturing facility, Beothuk Energy is also proposing to build an offshore wind farm demonstration project that will produce 180MW of green electricity.

Proponents of the project are in the process of implementing the environmental assessment process, and securing permits required to get the manufacturing facility in place and operating. The announcement of this manufacturing facility has ground-breaking potential for the western part of the province.

3.3.1: Weaknesses of Energy Policy in Newfoundland and Labrador: Lack of Policy Action and Targets

Newfoundland and Labrador's energy strategy maintains that the amount of wind energy that can be integrated into the provinces current electricity system is limited to approximately 80MW (Government of Newfoundland and Labrador, 2007). The province's wind energy strategy offers no incentives to renewable energy developers, and sets no target for wind energy development. The low installed capacity of wind energy in the province is a consequence of these weak energy polices.

For comparison, we can look at provinces such as Quebec and Ontario which have implemented strong policies to augment the amount of renewable energy generated. Quebec has a quantity-based policy, where the government has set a target to install 4,000MW of wind capacity by 2015 using a series of calls for tenders (Sustainable Prosperity, 2012). Ontario uses a price-based program, the Feed-in-Tariff, to attract renewable energy companies by providing guaranteed pricing for certain forms of renewable energy projects. Ontario aims to have 10,700MW of installed capacity in renewable energy (wind, solar, and bioenergy) by 2020 (Sustainable Prosperity, 2012). Other Atlantic Canadian provinces are far ahead of Newfoundland and Labrador as well. New Brunswick Power is seeking to have 400MW of installed wind capacity by 2015, while Prince Edward Island previously had a government target of 500MW set for the year 2013 (SYNova International Business Development, 2006).

The government of Newfoundland and Labrador has no real strategy for the development of wind energy, despite briefly outlining three policy actions in the province's 102 page energy strategy of 2007. The fact that the province ranks third last in installed wind energy capacity in Canada therefore comes as no surprise.

3.3.2: Lack of Higher Education Regarding Renewable Energy

Higher education is often cited as key to moving towards a low-carbon economy future. There is a desperate need to educate students who can work in future renewable energy areas, such as research, manufacturing or maintenance and operation of these systems. Newfoundland and Labrador has approximately 28, 000 post-secondary students, and none of these students are enrolled in a wind energy-related program. Many colleges and universities across the country have wind energy programs designed to provide students with in-depth knowledge about wind turbines: St. Lawrence College in Ontario; Lethbridge College in Alberta; and a number of universities such as McGill and McMaster all offer specialized wind energy programs. If Newfoundland and Labrador is to develop its wind resources, the province needs a training program to solve the shortage of skilled turbine technicians.

Prince Edward Island has responded to industry demand by developing a Wind Turbine Technician program based at Holland College. In the program's first year, it had over 100 applicants for the 12-15 available seats (Government of Prince Edward Island, n.d.). The Holland College program is one of the first Training Center for Renewable Energy (BZEE) certified programs in Canada, which is an internationally known certification for wind turbine training (Government of Prince Edward Island, n.d.).

Many other provinces have realized the need to have skilled, trained workers within the wind energy sector. It is no coincidence that the country's leaders in installed wind capacity – Ontario, Quebec, Alberta – all have higher education programs dedicated to the construction, maintenance, and development of wind energy.

3.3.3: A Manufactured Monopoly

In 2012, the provincial government passed *Bill 61* which effectively gave Nalcor a monopoly for the sale and distribution of wholesale power in the province as part of the deal for the Lower Churchill development (The Gulf News, 2013). A monopoly can be defined as a specific person or enterprise as being the only supplier of a particular commodity. Monopolies are characterized by a lack of economic competition (Feehan, 2013); monopolies require a greater regulation by government of their activities.

Potential players in the energy supply sector will no longer be permitted in the province, meaning that no other power company will be able to independently develop resources or challenge rates in Newfoundland and Labrador. In other provinces, homeowners with small solar panels and wind turbines can sell excess energy back to the grid. This results in a "negative" power bill, which is actually positive for the homeowner. In this province, homeowners with small wind and solar projects cannot sell excess energy back to the grid.

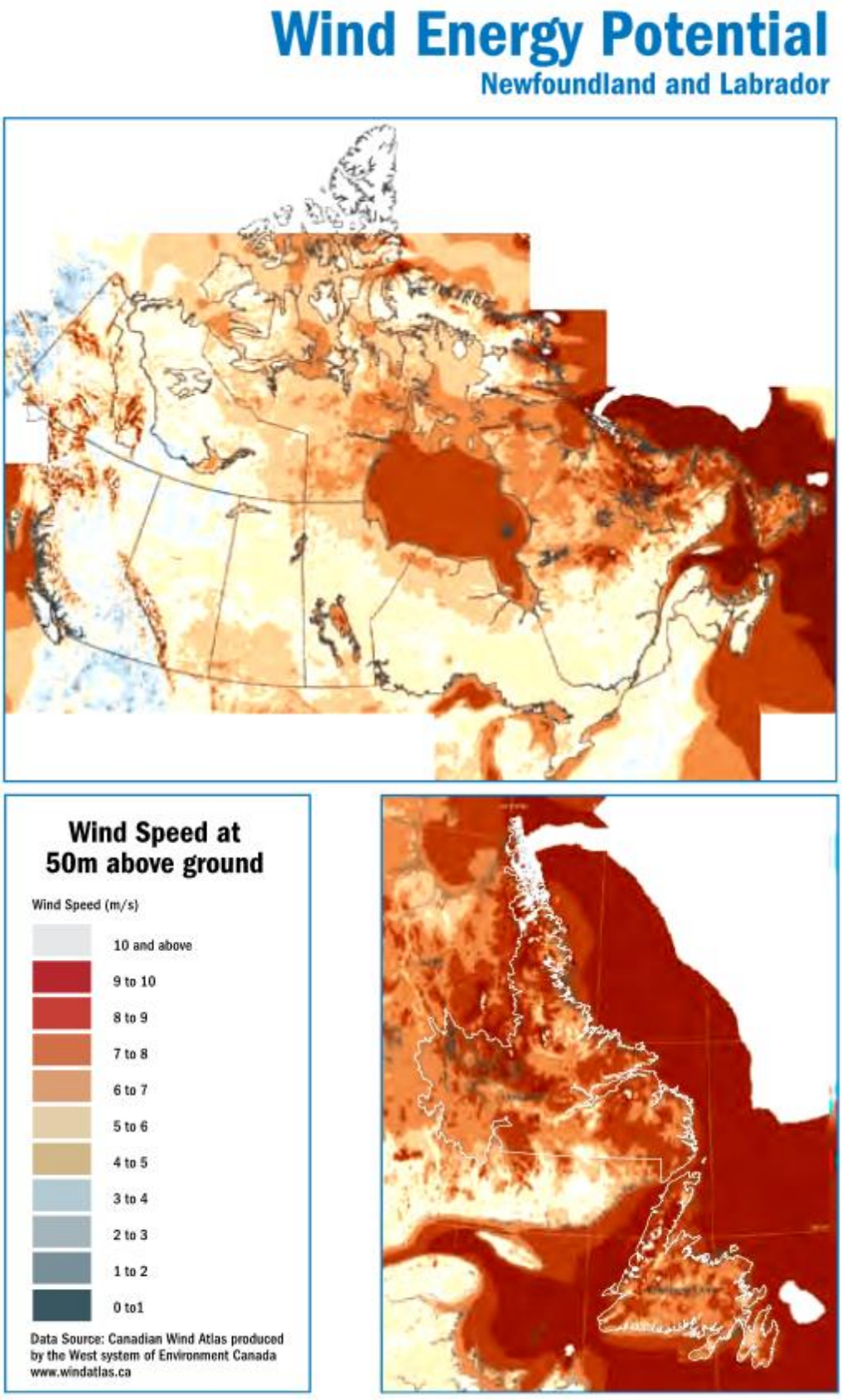
The introduction of a monopoly for the sale and distribution of wholesale power in the province is a major blow to the wind energy industry in the province. Despite significant interest from the private sector, these companies will no longer be permitted to invest in the province. A recent study demonstrates this interest by examining 14 proposals for wind power on the island since 1996, with a total potential capacity of around 255MW (Fisher, Iqbal & Fisher, 2009). The distribution of power in a particular jurisdiction often warrants a monopoly due to high initial infrastructure costs and possibilities of economies of scale, while the production of energy does not need a monopoly. The problem will *Bill 61*, is that by placing a monopoly on the sale and distribution of wholesale power in the province, they are effectively placing a monopoly on the production of power as well; independent producers only have the option to sell power to the Crown Energy Corporation, and are not allowed to use the provinces distribution system (Feehan, 2013).

Two projects in particular illustrate how damaging this policy will be. In 2006, Labrador Ventus proposed the development of a 1000MW wind farm in Labrador – this would have been the biggest wind project in Canada (Labrador Ventus Limited Partnership, 2006). In the same year Labrador Coastal Equipment Ltd. and Unity Bay Energy Ltd. proposed the development of a 600MW wind farm on the Avalon Peninsula (Labrador Coastal Equipment Ltd., & Unity Bay Energy Ltd., 2006). Under *Bill 61* these projects will never even be considered – missing out on $3.2 billion in potential direct investment, 4000 direct job years of employment and 12,800 job years of indirect employment (Labrador Ventus Limited Partnership, 2006).

3.4.1: Opportunities of Wind Energy Policy in Newfoundland and Labrador

Newfoundland and Labrador has higher average wind speeds than almost any other jurisdiction in North America (Khan, & Iqbal, 2004) (Figure 1). The Bonavista Bay Region of the province has been rated as the most promising area for wind energy potential (300-1000 w/m² at ten meters elevation). The Burin Peninsula and Northern Peninsula have medium wind resources with a power density of 150-200 w/m² at ten meters elevation. Wind energy on the Avalon Peninsula varies between 4.5 – 6 meters per second (m/s), this region has relatively lower potential (Khan, & Iqbal, 2004). Average annual wind speed in most parts of the province at 10 meters height is 6.5 m/s, while at 50 meters height this figure increases to 8.1 m/s (Blacker, & Iqbal, 2006).

Figure 1


Wind Energy Potential
Newfoundland and Labrador
Wind Speed at
50m above ground
Wind Speed (m/s)
10 and above
9 to 10
8 to 9
7 to 8
6 to 7
5 to 6
4 to 5
3 to 4
2 to 3
1 to 2
0 to1
Data Source: Canadian Wind Atlas produced by the West system of Environment Canada
www.windatlas.ca

According to Environment Canada, Newfoundland and Labrador has the strongest winds of any province, with most stations recording average annual wind speeds greater than 20kmh (Fisher, Iqbal & Fisher, 2009). In order to gain an understanding of this potential, an estimate of total island wind power was calculated. This is essentially an estimate of how much energy could be produced if the entire island was converted to a wind farm. The study concluded that approximately 9.47 x 10^5 gwh of energy could be produced, or about 117 times the electricity consumed on the island in 2006 (Fisher, Iqbal & Fisher, 2009).

3.4.2: Assessment of Wind for the Isolated Island of Newfoundland

Manitoba Hydro International (MHI) was engaged by the Government of Newfoundland and Labrador's Department of Natural Resources, to provide a review on the accuracy of reports provided by Nalcor on the subject of wind in an Isolated Island option. Two reports on the development of wind for the Isolated Island of Newfoundland were reviewed; Hatch's wind integration – Isolated Island, and Nalcor's report on wind integration – Voltage Regulation and Stability Analysis (MHI, 2012).

Based on the study's findings, MHI did not recommend integrating any more than 10% of wind energy into our current electricity system, as recommended by the 2012 Hatch Study and adopted by Nalcor for an Isolated Island option. MHI found that large-scale wind development, as a replacement for Holyrood Thermal Generating Station, is not the least cost option for energy and does not represent good utility practice at this time (MHI, 2012).

Even though it is not economically feasible to entirely depend on large-scale wind at this time, the findings of this study do offer some opportunity for the development of wind on the island. The study recommends that the Isolated Island should not exceed a 10% wind penetration level at this time. A study commissioned by Nalcor Energy identifies that if power system-constraints can be addressed cost effectively, the Isolated Island could consider an additional 100 MW of wind energy by 2025, and a further 100MW by 2035 (Navigant, 2011). Developing this amount of wind energy by 2035 would represent a 370% increase over 2014 levels. On average, when compared to the cost of producing energy at the province's Holyrood Thermal Generating Station, this amount of wind energy would save consumers roughly $38 million dollars per year. 254 MW of wind energy would power roughly 58, 000 homes, avoid the consumption of 1.35 million barrels of oil, and reduce GHG remissions by 670, 000 tonnes.

3.4.3: Potential for Small Scale Wind Projects on the Island

The value of small scale projects has been documented for hydrogenating stations (Fisher, & Iqbal, & Fisher, 2009). The potential is large for small hydro and wind projects on the island; small projects merit consideration as future generation options and even have the potential to replace thermal generation in Newfoundland and Labrador (Fisher, Iqbal & Fisher, 2009).

While there is significant technical and economic potential for wind projects on the island, the limiting factor for wind development will be the power system and transmission capacity for wind (Fisher, Iqbal & Fisher, 2009). The main factors affecting integration costs of wind are penetration level, forecasting reliability, geographic diversity, and control/flexibility of the overall power system. With an updated transmission and control system, the island portion of the province would be ideal for high wind penetration (Fisher, Iqbal & Fisher, 2009).

An additional benefit of small scale wind projects across the island is that it will allow higher wind penetration at lower cost than large wind farms (Fisher, Iqbal & Fisher, 2009). A study in Quebec simulated large scale wind and small, distributed wind and concluded that that benefits of small wind projects are numerous and include: reduction of the amount of required backup capacity, elimination of periods with zero wind production, and less impact on river flows (Belanger & Gagnon, 2002).

Other jurisdictions' energy systems with large amounts of hydropower, such as Newfoundland, have considered total wind penetration up to 23% and 30% to be technically and potentially economically feasible (Fisher, Iqbal & Fisher, 2009). This suggests it would be possible, with updated transmission and system control, to integrate up to 440MW of wind capacity, or about 1350 GWh/hr, into the island system (Fisher, Iqbal & Fisher, 2009).

3.4.4: Intellectual Property Development

As discussed in section 3.2.2, the state-of-the-art research taking place in Ramea, Newfoundland is a key strength of wind energy policy in Newfoundland and Labrador. The wind-hydrogen-diesel system in Ramea was designed and built by Newfoundland and Labrador Hydro, and its parent company Nalcor will retain all intellectual property rights related to the project.

In addition to reducing pollution and reducing and potentially replacing reliance on fossil fuels in remote communities, this project is one of the first in the world for an isolated wind-hydrogen-diesel solution. There is an incredible opportunity here for intellectual property development. Ramea is one of 26 communities in the province with no access to the electricity grid; there is obvious potential here to spread this technology across the province (Market Research Associates, 2011).

Although currently a pilot project, this system has already attracted interest internationally and from other provinces. The system plays to the province's strengths in engineering and technology for cold and harsh weather climates. This project is considered to have potential for adaption in Northern climates such as Alaska, Nordic countries, India, China and similar regions (Market Research Associates, 2011).

Through involvement with this and other projects, Nalcor has spawned several small successful, and innovative companies with expertise that are looking for access to the grid to provide sources of renewable energy (Market Research Associates, 2011). Although these companies are not yet fully operational, they demonstrate potential for further development of the sector.

3.4.5: Opportunities for Wind Energy in Labrador

A conservative estimate of available wind energy resources in Labrador is somewhere around 5000 MW, this figure exceeds the entire installed capacity of Canada in 2011 (The Telegram, 2011). As discussed in section *3.3.3*, a recent proposal amounted to 1000MW for a single wind project in Labrador.

In 2009, the Government of Newfoundland and Labrador invested approximately $250 thousand dollars for Hydro to investigate the integration of alternate energy sources into isolated, off-grid communities that rely on diesel generation as their primary energy source in Labrador. This study concluded that wind energy has the most promise as an alternate energy source in Labrador (Newfoundland and Labrador Hydro, 2009).

Based on a number of simulations, it was found that most communities studied would be able to economically integrate wind energy into their existing system. Nain, Hopedale, Makovik, and Cartwright were the most promising sites for wind energy development, being able to integrate as much as 47% wind energy into their current systems (Newfoundland and Labrador Hydro, 2009).

3.4.6: Economic Benefits of Wind Energy Development

Wind energy further supports rural communities by providing tax revenues and jobs for rural municipalities, and lease income for landowners ($2,500 – $5000 per year, per turbine) (Labrador Ventus Limited Partnership, 2006). This paper has identified that it is economically and technically feasible for the island portion of the province to develop an additional 200 MW of large-scale wind energy by 2035 (See section 3.4.2). The average cost per MW to develop a wind project is approximately $2 million dollars. Therefore, the installation of one MW of wind energy creates $2 million in direct investment, along with the creation of 2.5 direct job years of employment, and eight indirect job years of employment (Labrador Ventus Limited Partnership, 2006). Developing an additional 200 MW of wind energy on the island of Newfoundland would therefore result in $400 million dollars in direct investment. This would create 500 direct job years of employment, and 1,600 indirect job years of employment.

The potential for economic benefits on the mainland portion of the province is much greater. As shown above, conservative estimates for Labrador's harvestable wind energy resources are approximately 5000 MW. Developing this amount of wind energy would result in $10 billion in direct investment; create 12, 500 direct job years of employment, and 40, 000 job years in indirect employment. It is unlikely that Labrador would require this amount of energy, but there is significant demand from industrial and mining users, and a large potential for export to Nova Scotia, other Atlantic Provinces, and the Eastern United States (Department of Natural Resources, 2012b). Hydroelectricity projects currently being developed and considered in Labrador amount to 3,074 MW of energy; there is clearly demand for this amount of energy (Department of Natural Resources, 2012c).

Unlike conventional power plants, wind farms can be installed quickly (about one year) and on a modular basis that allows wind energy to respond to much more accurate projections of short-term changes in demand (Labrador Ventus Limited Partnership, 2006). Wind energy benefits consumers, unlike other electricity sources. The cost of production of wind energy continues to decline, and wind energy has no fuel cost, ensuring long-term price stability (Labrador Ventus Limited Partnership, 2006).

3.5.1: Threats of Wind Energy Policy in Newfoundland and Labrador: Other Priorities

One of the biggest threats facing the development of wind energy in Newfoundland and Labrador is a question of priorities. Since the announcement of the Lower Churchill hydro mega-project in Labrador, there has been little attention given to potential developments of other forms of renewable energy.

In 2011, a reporter from The Telegram in St. John's contacted the Department of Natural Resources about the subject. The emailed response read "The government of Newfoundland and Labrador has recently announced the development of Muskrat Falls as part of the Lower Churchill Project. We believe that this development is the most appropriate project to meet the

energy needs of Newfoundland and Labrador, and any wind development projects must take place in the context of the Lower Churchill Project," (The Telegram, 2011).

Hydro and wind energy are often touted as perfect compliments (Fisher, Iqbal & Fisher, 2009). Wind cannot replace hydro, but it is definitely an opportunity which should not be ignored. Though it has been identified that wind energy is not the least cost option for the island of Newfoundland, ignoring this valuable resource will result in the province will failing to realize any of the other opportunities presented in this analysis.

3.5.2: Lack of Transmission-Access

Newfoundland and Labrador's Planning Load Forecast (PLF), or how much the province predicts our energy consumption to grow, is predicted to grow at a rate of 1.2% per year. Industrial users in Labrador currently consume 300MW a year, but this figure could grow to 750MW-1125MW as industrial development grows (Department of Natural Resources, 2012c). Even when these factors are taken into consideration the province has far more energy than required for domestic use, the potential for large-scale wind energy is clearly for export markets.

Markets considered as opportunities for electricity exports include Ontario, the Maritime Provinces, Quebec, and the Northeastern United States. Each of these markets has specific challenges and opportunities, but each requires transmission access. The United States Federal Energy Regulatory Commission (FERC) open access transmission policies and competitive wholesale markets for electricity make Northeastern United States markets an open marketplace for electricity imports. Many Canadian jurisdictions have adopted open access policies to provide fair access to market participants. Ontario is also considered a prime market opportunity for electricity exports if sanctioned before Ontario invests in other sources to meet its long-term needs (Department of Natural Resources, 2012c).

In order to export electricity to Ontario and US Northeastern markets, Labrador power would require transmission access through Quebec. Hydro Québec's transmission system is one of the most extensive in North America with over 515 substations, and greater than 33, 000 kms of lines at different voltages. The system has multiple transmission connections with neighboring systems in Canadian provinces and various US Northeastern states (Department of Natural Resources, 2012c). (Table 1).

System	Import Capability To Quebec (MW)	Export Capability from Quebec (MW)
New York	1,100	2,000
New England	1,870	2,260
Ontario	1,945	2,705
New Brunswick	785	1,029
Newfoundland & Labrador	5,150	0

Source: Hydro-Quebec TransÉnergie

Table 1: Import and Export Capability to and from Quebec

Despite having an Open Access Transmission Tariff (OATT), fair access has not been provided to Newfoundland and Labrador for the development and export of energy projects through Quebec. If the province cannot gain transmission access through Quebec, Newfoundland and Labrador will have incredible difficulty developing and exporting electricity to the various market places discussed above. The Maritime Link currently being developed as part of the Upper Churchill project is a positive development for the export of electricity; this will be further explored in section *4.4: Pursue Export Options for Large-Scale Wind Projects.*

3.5.3: Competition from Maritime Provinces

The Maritime Provinces including Nova Scotia, Prince Edward Island, and New Brunswick all have interest in exporting substantial amounts of wind energy to the Northeastern United States. This is demonstrated by a study commissioned by the Canadian Wind Energy Association entitled "Evaluation of Opportunities and Barriers to Wind Power Exports from the Maritime Provinces to the US Northeast". Newfoundland and Labrador may lose a great opportunity for exporting wind energy if the province does not act quickly.

Current export potential for wind energy in the Maritime Provinces is about 1000MW, but the potential for trade is much greater with a rough estimate of 2500MW by 2020 (Power Advisory LLC, 2009). The same study indicates that the Maritime Provinces can economically integrate between 5000-7500MW of wind energy into their energy grids at this point, while estimating that potential wind resources in the Maritime Provinces is 16,500MW (Power Advisory LLC, 2009).

Electricity demand for the region as a whole – including both the Maritime Provinces and the

Northeastern United States – is expected to grow at a rate of 1.3% per year from 2010-2025, with a total increase of 25%. No new coal-fired generating stations will be built in New England, and 5% of thermal generating stations are expected to be retired per year (Power Advisory LLC, 2009). The Maritime Provinces threaten the potential for Newfoundland and Labrador to export massive amounts of wind energy to the Northeastern United States.

Another problem facing the export of electricity to the US is that our southern neighbor is moving towards self-sufficiency in energy sources through the use of hydraulic fracturing and other sources of renewable energy. The IEA predicts that the US could become energy self-sufficient by 2035 (Energy and Commerce Committee, 2013). Soaring shale gas output is helping the world's largest oil consumer achieve its highest level of energy independence in two decades (Energy and Commerce Committee, 2013).

4.1: Policy Recommendations for the Development of Wind Energy: Amend Bill 61

As discussed in section *3.3.3, Bill 61* has effectively given the province's Crown Energy Corporation a monopoly over the sale and distribution of wholesale power in the province. The number one conclusion of this analysis is that *Bill 61* should be amended by the provincial government. With *Bill 61* remaining in its current form – the province will experience great difficulty in recognizing any of the opportunities presented in this analysis.

Basic microeconomics tells us that when markets are competitive, mutually advantageous gains will occur whenever an isolated market is integrated with others in which the same commodity is traded (Feehan, 2013). If the previously isolated market was relatively small, then its share of overall gain will be relatively larger. *Bill 61* will deny the province's own people these potential gains from trade (Feehan, 2013). Other than claiming that these measures are needed to advance the Lower Churchill project, government has provided no real rationale for them.

Bill 61 means that NL Hydro's industrial customers must purchase electricity from NL Hydro with no right to buy from another party or self-generate. This is an anti-innovation policy. Customers would self-generate only if they could do so at a lower cost than purchasing – this policy eliminates the incentive to develop cost-saving innovations (Feehan, 2013). The exclusivity law leaves little incentive for independent power producers to establish on the island – they would have no domestic market. The Newfoundland and Labrador government has made the island market completely captive to its monopoly corporation (Feehan, 2013).

Another implication of *Bill 61* is that access to US markets will be compromised (Feehan, 2013). In the US, FERC is the key governing agency for wholesale electricity markets. FERC's main instrument to foster competition is the requirement that owners of transmission systems allow others to use them on a non-discriminatory basis. There must be Open Access Transmission Tariffs (OATT) that allow electricity generators to use transmission systems to send their electricity to wholesale markets. FERC imposes a reciprocity rule: if Canadian firms use a state's OATT, in return they must make OATT's available to whoever wants to use their transmission system. As a result, all major transmission owners in every province except for Newfoundland and Labrador currently have OATT's (Feehan, 2013). If this province wants direct access to US wholesale markets for electricity from Muskrat Falls, Gull Island, wind developments, or other projects, it will be obligated to have an OATT (Feehan, 2013).

Under *Bill 61,* North America's greatest wind resources will continue to go unharnessed (See section *3.3.1*), private corporations will not be able to integrate an additional 200MW into the islands electricity system (See section *3.3.2*), there will be very little incentive for the

development of small-scale wind energy (See section *3.4.3*), Labrador will miss out on billions of dollars in potential investment (See section *3.4.5*), and the province will miss out on many additional economic benefits (See section *3.4.6)*. *Bill 61* must be amended to allow for easier access for private companies, and individual households to produce and distribute electricity generated from wind.

4.2: Strengthen Targets/Policy Actions

Newfoundland and Labrador's Energy Plan indicates that the province's current electricity system is able to integrate a maximum of 80MW of wind energy. This paper has identified that the isolated portion of this province is actually capable of integrating more than 250MW of wind energy by 2035 - the province clearly needs to update and strengthen its wind energy targets. Given the strength of the resource and the level of interest expressed by developers, we should have more ambitious targets in the province.

Newfoundland and Labrador must develop a policy to ensure its wind resources are developed in a purposeful, focused manner. A wind energy plan will strengthen the province's competitive position in the market place and maximize benefits for residents. The province must act quickly to take advantage of the opportunities presented in this paper. The development of an additional 200MW of wind over the next 20 years should be economic and environmental strategic priorities for the government. Developing a wind energy plan with clear targets will help meet these goals – 200 MW of additional wind energy does not need to be an end, but it is a logical next step forward. Developing a wind energy plan would set out a framework for wind energy development, allowing prospective developers to know the ground rules to ensure a fair and open process.

The development of a provincial wind energy plan should include the establishment of educational programs to train engineers and technicians to design, install and maintain renewable energy systems. There is a serious shortage of skilled professionals with experience in renewable energy (Jennings, 2009). The types of professionals in demand include designers, installers, service and sale representatives, policy analysts, scientists, engineers, teachers and researchers. Without these trained professionals the quality of renewable energy systems may be compromised and the demand for renewables may be adversely affected as a result (Jennings, 2009).

Education has a vital role to play in the development of a sustainable society – it raises awareness about new developments, provides training for professionals, and trains researchers who will develop the next generation of systems (Jennings, 2009). Community education creates confidence in new products and trains the public to use them effectively.

Experience shows that firms who have given adequate attention to these issues thrive in highly competitive, high technology market places. Firms who have ignored the need to invest in information and education have failed, despite having good products (Jennings, 2009). Education has a crucial role in the development of the renewable energy industry and should be included in any provincial wind energy plan.

4.3: Adopt Policies to Encourage the Development of Small-Scale Wind

Section 3.4.3 of this paper examines the potential for the development of small-scale wind projects on the island. The analysis concluded that it is possible, with updated transmission and system control, to integrate up to 440MW of wind capacity into the island system. The technical

feasibility and potential for small-scale wind is much greater than large-scale wind in the province at this time. The provincial government should adopt policies to encourage the development of small-scale wind enterprises.

Small-scale wind energy is a distributed generation technology that provides electricity directly to homes, farms and business with a maximum generating capacity of 100kw (Weiner & Koontz, 2010). Rather than concentrating energy production in a few large-scale operations, small scale wind farms generate electricity in relatively smaller amounts at a wide variety of locations – projects or turbines are often owned by individual homeowners. Government can choose from many policy tools to encourage small-scale wind operations, but all options are placed within three broad categories: financial incentives, mandates, and education and outreach (Weiner & Koontz, 2010).

Financial incentives are designed to stimulate private investment in small scale wind turbines by helping the technologies overcome financial barriers that are frequently responsible for preventing their more widespread adoption in the private sector (Menz & Vachon, 2006). Examples of financial incentives include tax credits or exemptions, grants and low-interest loans. Net metering is a policy that requires utilities to compensate consumers for the power they generate using small scale wind turbines and other distributed technologies (Byrne & Hughes & Rickerson & Kurdgelashvili, 2007). The goal of net metering is to improve the financial feasibility and reliability of grid-connected small-scale wind turbines by allowing customers to receive credit for producing more electricity than they consume (Weiner & Koontz, 2010).

The Government of Newfoundland and Labrador has achieved some success with this type of policy tool: the $25 million Newfoundland and Labrador Green Fund discussed in *section 3.2.3* is designed to reduce GHG emissions by 200, 000 tonnes, and has contributed to the development of small-scale wind energy projects. It is recommended that the Government of Newfoundland and Labrador extend the Green Fund for another 10 years, with a special emphasis on small-scale wind farms.

Mandates are another category of policy tools used in support of renewable energy. Renewable Portfolio Standards (RPS) are the most common example of this type of approach; they set a requirement for a specified percentage of a utility's generation to come from renewable sources by an established date in order to promote greater renewable energy development within a particular jurisdiction (Vachon & Menz, 2006). This type of regulation does not require a jurisdiction to use small- scale wind, but they do allow small wind systems to be one of the many renewable energy technologies that policy-makers can support to fulfill the RPS (Weiner & Koontz, 2010).

The final major category of policy tools are those which are used to promote greater awareness and outreach about small-scale wind energy (Weiner & Koontz, 2010). An example of this type of approach is anemometer loan programs – where government provides a loan of a device which will allow individuals to measure wind resources for small wind systems. An additional example of this type of approach is simply efforts to train small wind installation professionals (Weiner & Koontz, 2010).

The literature reviewed in this paper indicates that the island portion of the province is capable of incorporating as much as 440MW of small-scale wind energy into its electricity system – this is much greater than the potential for large-scale wind projects on the island, due to technical limits of our current electrical system. The provincial government should pursue policy a variety of policy tools from all major categories in order to provide incentives for the development of small-scale wind operations.

4.4: Pursue Export Options for Large-Scale Wind Projects

As discussed in Section 3.5.2, one of the major problems in the province of Newfoundland and Labrador is the lack of transmission access for electricity exports. Newfoundland and Labrador has the ability to produce far more energy than it requires for domestic use - if the province is to develop its massive wind energy resources, it must secure transmission access to other jurisdictions for export of electricity.

Pursuing the development of the Labrador-Island Transmission Link, and the Maritime Link is a step in the right direction. The Labrador-Island Transmission Link will have 900MW export capacity to the island portion of the province. The Maritime Link will include the construction and operation of a 500MW HVdc line, a 230HVac line, and associated infrastructure between the Island of Newfoundland and Nova Scotia (Emera, 2014). For the first time in the history of Newfoundland, the Maritime Link will connect the island to North America's energy transmission system. This project will make the abundance of energy in the province more accessible and provide a reliable way to develop more renewable energy sources, such as wind (Emera, 2014).

Beothuk Energy, the company responsible for the proposed 180MW wind farm discussed in section *3.2.4*, has already identified the Maritime Link as having the greatest potential for exporting electricity from their project (CBC News, 2014). Beothuk Energy has formally submitted a request to explore a power-purchase agreement with the provinces' Crown Energy Corporation which would allow for the export of wind electricity through the Maritime Link (CBC News, 2014).

The SWOT Analysis within this paper has identified vast opportunities for the development of wind energy in the province. Without reliable and secure transmission access, the province will be unable to develop this tremendous resource for export. The provincial Government should ensure that potential wind energy developments have transmission access through the Maritime Link, and should continue pursuing other electricity export options.

5.0: Conclusion

Newfoundland and Labrador is a leader in energy production amongst Canada's provinces and territories. The energy sector in the province creates thousands of jobs and additional financial benefits for residents. Despite the massive gains the province has achieved through its energy sector, this paper has demonstrated that the province has missed out on several major opportunities by failing to develop its wind energy resources.

The rationale for further pursuing the development of wind energy in the province is clear. By developing locally available, renewable sources of energy, the province will be able to improve its energy security, contribute to the global effort in limiting the impacts of climate change, entirely avoid health and environmental impacts associated with burning fossil fuels, and reduce the threats of energy poverty. Pursuing the development of wind energy also makes sense economically. Wind energy technology is already competitive with fossil fuel technologies and wind energy has few negative economic externalities. By shifting subsidies away from fossil fuels and investing in wind energy the province may create thousands of clean energy jobs.

Newfoundland and Labrador has begun to realize some of the benefits from the development of wind energy; existing wind developments are powering thousands of homes and reducing our reliance on fossil fuels and associated emissions. State-of-the-art wind energy research is taking place in Ramea, Newfoundland – entirely eliminating emissions from an isolated community.

The Newfoundland and Labrador Green Fund has helped us realize the benefits of small-scale wind. Ground breaking potential has been unveiled in Corner Brook, with a wind project manufacturing facility in the works that will create hundreds of jobs.

There are significant weaknesses in Newfoundland and Labrador's wind energy policy however. The province has no official wind energy policy and our targets for wind energy development in the current energy policy are incredibly weak. There are no higher education programs in regards to renewable energy in the province – this is preventing us from having the wind energy experts required to grow the sector. *Bill 61* has all but ruined the potential for private wind energy development in the province. It is against the law for homeowners to sell self-produced energy back to the grid and countless major wind energy projects have been denied.

The opportunities are vast for wind energy in the province. The provinces energy strategy correctly identifies that we have the greatest potential for wind energy in North America. The province is capable of integrating an additional 200MW of large-scale wind energy into the grid by 2035. The greatest potential is for development of small-scale wind – with some studies suggesting the integration of 440MW of wind energy may be economically and technically feasible. Intellectual property development should be pursued for the state-of-the-art research taking place in Ramea, and the provinces' technologies and innovative businesses could spread all over the world. There is 5000MW of wind energy available for harvest in Labrador alone, the province has the potential to create tens of thousands of jobs and generate billions in investment.

The provinces' wind energy sector is being threatened in a number of ways. The province simply has other priorities and is missing out on major opportunities, the province lacks transmission access for exporting surplus electricity from wind, and the province is facing increased competition from the Maritime Provinces.

Based on observations from the SWOT analysis within this research, I have presented four key policy recommendations which will allow for the development of a strong wind energy sector within the province. First and foremost the province needs to reconsider its controversial *Bill 61* or the wind energy sector may never get off the ground. The province must develop a comprehensive wind energy plan to guide the development of the resource in the province; such a plan should strengthen wind energy targets and develop higher educational programs for renewable energies. The provinces' greatest opportunity for wind energy is small-scale; the Government should adopt policies to encourage the development of small-scale wind operations. The final recommendation presented in this analysis is for the Government to continue pursuing export opportunities such as the Maritime Link; this is a step in the right direction and a crucial step for getting North America's greatest wind energy resource to the energy market.

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