# DALHOUSIE UNIVERSITY GENERATING RENEWABLE ENERGY THROUGH THE COMFIT PROGRAM:

## AN EXPLORATORY STUDY



rethink
for a sustainable campus
DALHOUSIE UNIVERSITY
Inspiring Minds


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**Executive Summary**

Our team undertook an exploratory research project to explain how Dalhousie University could produce renewable electricity using wind power within the context of Nova Scotia's Community-based Feed in Tariff (COMFIT) program. The COMFIT program allows communities to create renewable electricity that connects to the provincial electricity grid. In return, Nova Scotia Power Inc. (NSPI) pays the communities a set, premium rate per kilowatt hour (kWh) for their energy.

Efficiently structured interviews were conducted with people who had technological, financial, and/or administrative expertise, as well as, potential partners and current COMFIT applicants. The results have been presented under six categories: (1) project scale, (2) project finance, (3) partnership models, (4) project locations, (5) student engagement opportunities, (6) application process.

The development of a COMFIT project requires a large, up-front capital investment. Different financing and partnership options were explored. The majority of interview participants believed that Dalhousie University would be able to make a valuable financial contribution to a COMFIT project by contributing equity and potentially helping obtain a low interest-rate loan. After the payback period a COMFIT project generates revenue that could be re-invested into the Dalhousie University community. Due to setback regulations Dalhousie University would lease, purchase, or partner to obtain a suitable location for a COMFIT project. Prospective locations must have sufficient wind resources, access to available grid capacity, zoning regulations that comply with the scale of the project, along with meeting COMFIT application regulations. There are opportunities for student learning and engagement is a COMFIT project.

By participating in this program Dalhousie University has the opportunity to mitigate climate change, meet greenhouse gas (GHG) reduction targets, curtail rising energy costs, generate revenue and engage students in learning opportunities in the emerging renewable energy industry.

Dalhousie University has the right financial, technological, and partnership resources available to ensure the success of a COMFIT undertaking. The report provides the information and contacts necessary for additional research into a Dalhousie University COMFIT project.

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## Glossary

**Active Pool:** A stock offering with a specific investment goal. A CEDIF can have an Active Pool offering when it is raising money for a specific COMFIT project that is has applied for.

**Joint Venture Company:** A joint venture is a particular business activity carried out in concert by two or more persons. There is no legislation regulating joint ventures in Canada. Where a new corporation is formed to carry on the joint venture business, it is sometimes referred to as an incorporated joint venture (Nova Scotia Department of Agriculture, 2012).

**Limited Partnership:** A limited partnership consists of one or more general partners who manage the business and one or more limited partners who contribute capital but do not participate in management (Nova Scotia Department of Agriculture, 2012).

**A Level Shares:** In a COMFIT project A-level shares refer to the proportion of financial contribution a partner gives to a project and to the proportion of financial return a partner receives from the investment.

**Blind Pool:** A stock offering with no stated investment goal for the funds that are raised from investors. In a blind pool, money is raised from investors, usually trading on the name of a particular individual or firm, but few restrictions or safeguards are in place for investor security. A CEDIF can have a Blind Pool offering when it is investing in other renewable energy project but hadn't initiated its own project. (Investopedia, n.d.)

**C Level Shares:** In a COMFIT project C-level shares refer to decision-making control for the project.

***Community Economic Development Investment Funds (CEDIFs):*** A pool of capital, formed through the sale of shares (or units), to persons within a defined community, created to operate or invest in local business.

**Debt-financing:** When a firm raises money for working capital or capital expenditures by selling bonds, bills, or notes to individual and/or institutional investors. In return for lending the money, the individuals or institutions become creditors and receive a promise that the principal and interest on the debt will be repaid (Investopedia, n.d.)

**Distribution Level:** Nova Scotia's electricity is connected via a province-wide energy distribution grid. All COMFIT projects are subject to a limited amount of energy capacity (roughly 100 MW) and this distribution levels vary throughout the province. Selecting a site that has access to connection lines and enough energy capacity are vital to the success of the project.

**Equity:** The amount of funds contributed by the stockholders (the owners)plus the retained earnings (or losses). This value is representing on the company's balance sheet and is also known as "shareholders' equity" (Investopedia, n.d.).

**Eligible Communities** Municipalities or wholly owned subsidiaries of municipalities, Mi'kmaq band councils, co-operatives, not-for-profits, community economic development corporations, (CEDIFs), universities, and entities that use the heat from combined heat and power biomass facilities (Nova Scotia Department of Energy).

**Grid Capacity Factor:** The capacity factor is the percentage of the total output capacity that is actually generated on an annual average basis (Nova Scotia Department of Energy).

**Power**: The rate at which electricity is generated or used, measured in watts.

**Scope 1 Emissions**: Direct GHG emissions and removals from fuel used to create steam, hot water, and cooling generated and distributed through the district heating/cooling network from the central heating plant within organizational boundaries of an institution (Dalhousie University 2009).

**Scope 2 Emissions**: Indirect GHG emissions and include indirect emissions from the generation of imported electricity from Nova Scotia Power during the production of electricity used on campus. (Dalhousie University, 2009).

**Small Wind:** Under the COMFIT program small wind is categorized as turbines with a capacity of 50kW oat a wind speed of 11m/s and with a swept area of 200m2; and have a swept area be less than 200m2 (Nova Scotia Department of Energy).

**Big Wind:** Under the COMFIT program, big wind includes all turbines that generate more than 50kW of power at a wind speed of 11m/s (Nova Scotia Department of Energy).

**Power:** The rate at which electricity is generated or used is measured in watts. (For example a 25-watt bulb uses 25 watts of power).The amount of electricity generated or used is measured in watt-hours. (A 25 watt bulb that burns for an hour uses 25 watt-hours of electricity).

**1,000 watts = 1 kilowatt (kW)** (the power used by a typical home)
**1000 kW = 1 megawatt (MW)** (the power used by about 1,000 homes)
**1000 MW = 1 gigawatt (GW)** (the power used by about a million homes)
**1 gigawatt-hour (GWh) = 1 million kilowatt-hours** (Nova Scotia currently generates and consumes about 12,000 GWh of electricity per year)
(Nova Scotia Department of Energy, 2010)

**Wind Farm:** A group of interconnected wind turbines in the same location which are used to produce electricity (Ned Haluzan, August 24, 2011).

## LIST OF ACRONYMS

Cape Breton University (CBU)
Carbon Dioxide (CO2)
Carbon Dioxide Equivalent (CO2 eq)
Community Economic Development Investment Funds (CEDIFs)
Community Feed-In Tariff (COMFIT)
Environmental Goals and Prosperity Act (EGSPA)
Greenhouse Gas (GHG)
Halifax Regional Municipality (HRM)
Kilowatts (kW)
Kilowatt hours (kWh)
Megawatts (MW)
Megawatt hours (MWh)

## 1.0 Introduction

The Government of Nova Scotia has established a Community-Based Feed-In Tariff (COMFIT) program that allows communities to connect certain renewable energy projects to the provincial power grid and receive a premium rate for the power generated. Universities are considered eligible communities under the COMFIT definition; making participation in COMFIT an exciting opportunity for Dalhousie to meet part of their greenhouse gas (GHG) emissions.

The purpose of this research is to determine how Dalhousie could generate wind energy as part of the Nova Scotia COMFIT program. By using exploratory research this project will address preliminary consideration relevant to Dalhousie becoming a producer of renewable energy and will help decision makers at Dalhousie understand the opportunities for undertaking a wind energy project as part of the COMFIT program.

## 2.0 Background

### 2.1 Energy on a Global Scale

The world's current methods of extraction, production and consumption of energy are unsustainable. Fossil fuels including oil, coal, and gas, are finite natural resources that are being burned at unsustainable levels to meet global energy demand (Sims, et al., 2007; WWF, 2011). In 2009, according to a report by the World Bank, 75.09% of Canada's total energy consumption came from fossil fuels (Trading Economics, 2012). These fossil fuel energy sources are the main contributors to climate change; they produce GHG emissions and chemical pollution, put pressure on freshwater resources, and have severe impacts on our biodiversity and ecosystem services (WWF, 2011). The IPCC states that "fossil fuel energy use is responsible for about 85% of the anthropogenic carbon dioxide (CO2) emissions produced globally annually" (Sims et al., 2007). Since the mid-19th century, over 1100 gigatonnes (Gt) of carbon dioxide equivalent (CO2 eq) have been released into the atmosphere (IPCC, 2001, as cited by Sims, et al., 2007). Canada produced 0.734 Gt of CO2 eq, in 2008 alone. About 81% of these emissions came from the energy sector (Environment Canada, 2010).

As fossil fuel resources deplete and anthropogenic climate change threatens the survival of future generations, there is a strong need to derive our energy from more sustainable sources such as renewable energy. Renewable energy sources such as biomass, hydro-electricity, solar, wind and geothermal energy provide opportunities to generate energy in a clean and sustainable manner, they can contribute to energy security, and they help to protect the environment (Sims, et al., 2007; WWF, 2011).

### 2.2 Electricity in Nova Scotia

In June 2007, Nova Scotia committed “to have one of the cleanest and most sustainable environments in the world by 2020” (Government of Nova Scotia, n.d.). To achieve this vision, the province adopted the Environmental Goals and Sustainability Prosperity Act (EGSPA). The province has also developed new strategies and policies with other levels of government, private industry, and the public to become more sustainable (Government of Nova Scotia, n.d.). The EGSPA contains 21 goals for the province to achieve their commitment to become more sustainable. The goals range from reducing air emissions and waste, to ecosystem protection and switching to renewable energy. One of the goals is to have 18.5% of its total electricity needs come from renewable sources by 2013.

In April 2010, the Government of Nova Scotia released a document entitled “Renewable Electricity Plan: a path to good jobs, stable prices, and a cleaner environment” (Nova Scotia Department of Energy, 2010). This document provides a detailed plan for moving Nova Scotia toward their goal of 18.5% renewable energy, by promoting renewable energy and focusing on local energy sources instead of carbon based electricity (Nova Scotia Department of Energy, 2010). Beyond the 2013 goal, the plan details long term goals for renewable energy. The plan states by 2015, the province aims to have 25% of its electricity demand met by renewable sources, and by 2020 to have 40% (Nova Scotia Department of Energy, 2010).

As of 2011, the province’s electricity generation from renewable sources is about 14% from - still 4.5% away from their goal for 2013. The province still has 75% of the its energy from imported fossil fuels - most of which is coal - and about 10% from natural gas (Nova Scotia Department of Energy, 2011a). With such a dependency on fossil fuels, the energy security of the province is weakened and the province is susceptible to rising fuel prices. Not only does this drain wealth from the local economy, but as voiced earlier, fossil fuels have a negative impact on the environment and health of the planet (Nova Scotia Department of Energy, 2011a).

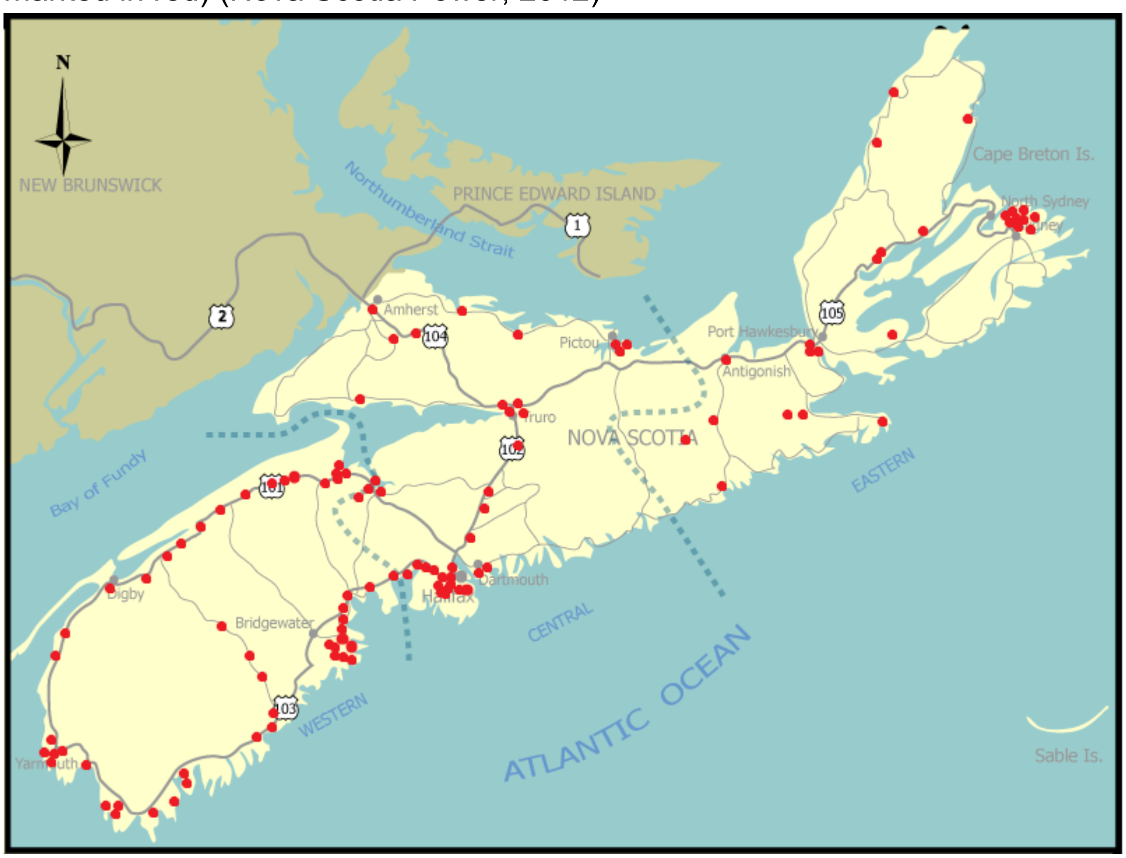
To help reach province’s goals, the government established a COMFIT program. The following section describes the COMFIT program.

### 2.3 About the COMFIT program

A Feed-in Tariff (FIT) is an incentive structure where a participating energy producer sells renewable electricity to a utility company that pays them a pre-determined, fixed rate set by the government (Engel & Kammen, 2009). Participants are guaranteed a fixed price over the time that has been set to cover the cost of generating the electricity and a reasonable rate of return for the producer (Nova Scotia Department of Energy, 2008). Wiginton (2010) states that, “Feed-In Tarrifs are the most proven incentive for the growth of renewable energy technology deployment.”

Nova Scotia has implemented a province wide FIT program that enables eligible communities to participate in producing their own renewable energy at an established rate per kilowatt hour (kWh). The program, termed COMFIT, was introduced for municipalities, First Nations, co-operatives, universities, non-profit groups, and businesses operating through a Community Economic Development Investment Fund (CEDIF) (Nova Scotia Department of Energy, 2011a). The overall goal of COMFIT is to promote province wide renewable energy production through the form of renewable energy projects. The concept of COMFIT is aimed at reducing anthropogenic effects on nature while providing long-term financial incentive (in the form of an established rate), to those projects that meet the COMFIT eligibility requirements. The program allows for approximately 100 megawatts (MW) of renewable electricity projects to connect to the grid.

**Figure 1:** Available Nova Scotia COMFIT Generation Capacity (connection lines are marked in red) (Nova Scotia Power, 2012)



Potential eligible applicants (and partners) include Mi'kmaq band councils and other First Nations groups, municipalities, CEDIFs, not-for-profit organizations, co-operatives, Universities, and biomass facilities among others. Under the COMFIT regulations a university such as Dalhousie is eligible to create a project and is considered its own 'community'. Possible forms of renewable energy production projects include biomass combined heat and power, small-scale in-stream tidal, hydroelectricity, small-scale wind (≤ 50 kW) and large-scale wind (> 50 kW), (Nova Scotia Department of Energy, 2012). Approved applicants have to go through a 12 step process that includes:

- Registration;
- Ownership structure;
- Project information;
- Site information;
- Technical information;
- Business case;
- Community support;
- Aboriginal requirements;
- Environmental requirements;
- Special places requirements;
- Other permits and approvals, and
- An affirming statement.

If applicants are planning on cooperating with another organization then they must own 51 percent of the COMFIT project and municipalities must own 100 percent of the project under the Municipal Government Act (Nova Scotia Department of Energy, 2011).

As mentioned above, this program will allow for approximately 100 megawatts (MW) of renewable electricity projects to connect to the grid at the distribution level. The energy produced from projects will feed into the province's electricity distribution grid and help to provide electricity to residences province wide. Turbines are often located on leased or purchased land located geographically outside of the applicant community due to set-back rules and other regulations. In order for the project to be feasible, site location in coordination with available energy capacity and access to connection lines must be taken into account.

In September, 2011 the Nova Scotia Utility and Review Board set the COMFIT rates, taking into consideration "basic cost recovery and a reasonable return on investment for each technology type." (Nova Scotia Department of Energy, FAQ, 2012) These rates were decided upon and set after extensive expert and public consultation.

The COMFIT rates are:

| | |
|---|---|
| Wind: < = 50kW | 49.9 ¢ per kWh |
| Wind: > 50kW | 13.1 ¢per kWh |
| Run-of-the-river hydro | 14.0 ¢ per kWh |
| In-stream tidal | 65.2 ¢per kWh |
| CHP biomass | 17.5 ¢per kWh |

As of February 27, 2012 there were over 95 projects submitted from more than 20 different community groups. Twenty of these have been accepted so far (Nova Scotia Department of Energy, 2012). The COMFIT program is scheduled to undergo a review in the summer of 2012. The review board is currently looking into the possibility of authorizing solar power as an eligible form of energy production under COMFIT regulations. This would allow for more communities to participate in COMFIT.

Dalhousie University (Dalhousie) is eligible to participate in COMFIT. As Dalhousie strives to become a more sustainable university, participating in such a program would help them take the next step towards meeting its renewable energy goals, creating a greener campus, reduce its own emissions on the environment, and receive a discount on its electricity bill. The following section details Dalhousie's commitment to becoming more sustainable.

### 2.4 Dalhousie University's Pledge for Sustainability

In 2008-2009 Dalhousie produced an estimated 109,510 tonnes of GHG emissions with electricity being the largest contributor to CO2 emissions (Dalhousie Office of Sustainability, 2010). To demonstrate their concern about global climate change and the effects it may have on our lives and environment, Dalhousie's President Dr. Tom Traves signed Dalhousie to the University and College's Climate Change Statement for Canada on December 11, 2009 (Dalhousie Office of Sustainability, 2010, p. 3). By signing the Climate Change Statement Dalhousie has pledged to take action to address climate change. One of these actions is to "exercise leadership by reducing emissions of GHGs in collaboration with our communities" (University of College Presidents' Climate Change Statement of Action for Canada, n.d.).

In 2010, Dalhousie created a Climate Change Action Plan to take action against climate change. The key goals of the plan are to reduce GHGs, adapt to a changing climate, and increase climate knowledge through key action strategies (Dalhousie Office of Sustainability, 2010). The targets to reduce GHG emissions from the baseline 2008-2009 year are:

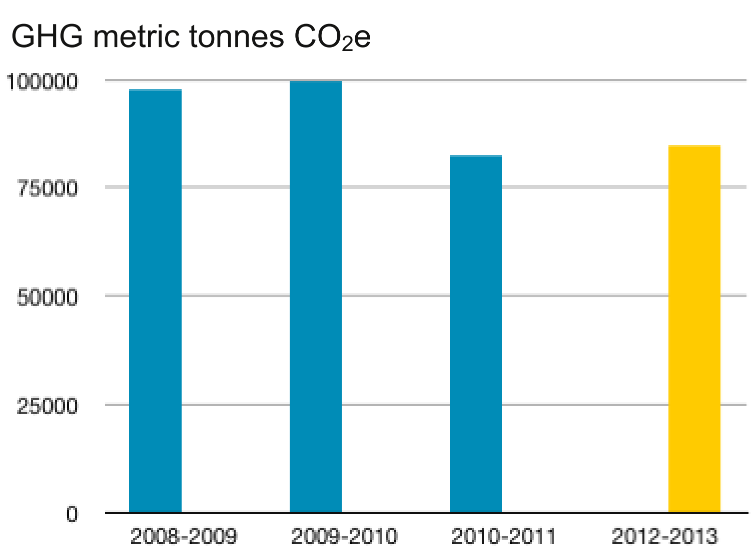
15% by 2013
20% by 2016
50% by 2020
Carbon neutrality by 2050

**Table 1** illustrates the University's GHG emissions sources and measurements of the emissions in tonnes of CO2e for 2008-2009 (Dalhousie College of Sustainability, 2010, p. 11). Purchased electricity is the largest contributor to tonnes of $CO_2$ emissions at Dalhousie.

| Emissions Summary | Tonnes CO2e |
|---|---|
| Scope 1: Stationary Combustion | 41.736 |
| Scope 1: Mobile Combustion (Fleet) | 1472 |
| Scope 2: Purchased electricity | 54.043 |
| Scope 1: Refrigerants | 269 |
| **Scope 3: Commuting Travel** | 11,990 |
| Total Emissions | 109,510 |

Dalhousie has achieved its GHG reduction targets for the past year and this year (Rochelle Owen, personal communication, April 3, 2012). For 2012-2013, Dalhousie's GHG emissions are 84,842 tonnes (Owen, 2012c).

**Chart 1** illustrates Dalhousie production of GHG emissions in metric tonnes since 2008-2009 (Owen, 2012c).



To meet the three goals of the Climate Change Action Plan and reach the GHG reduction targets, Dalhousie has created a variety of objectives including: switching to low and no emissions fuel for energy and transportation and increasing energy security. To take action on these objectives the plan puts forth adding renewable technologies to new and existing buildings and explore application of small and large scale grid/district heating projects (Dalhousie Office of Sustainability, 2010).

The COMFIT program provides Dalhousie with the opportunity to take action to achieve these objects.

### 2.5 Energy Options for Dalhousie to Participate in COMFIT

The COMFIT program has five options for renewable energy projects: Wind 50KW or less, Wind greater than 50KW, run-of-the-river tidal, in-stream tidal, and biomass. This project focused on examining opportunities for Dalhousie to participate in the COMFIT program through wind production.

Alternative options, tidal and biomass were considered but determined to be less viable than wind. Tidal energy is considered an immature technology. Furthermore, the technology still requires further research and development to be economically viable. Biomass involves the growing and harvesting of crops for energy. This process is water and energy intensive; moreover, the energy benefits are arguably outweighed by the costs. Subsequently, wind energy prevailed as the most reasonable and viable technology for a COMFIT project.

Wind is a clean and renewable energy source; the process of energy generation from wind does not produce emissions, nor does it contribute to climate change (Canadian Wind Energy Association, n.d.). Wind turbines are used to generate wind energy ; they “use the rotational motion of the blades to turn a generator to create electricity” (Nova Scotia Department of Energy, 2011b). In recent decades, technological advancements have increased the efficiency of harnessing wind energy (Botkin, Keller, and Heathcote, 2006). These advancements are making wind a more attractive option for energy. The small plot of land needed for constructing a wind turbine also make wind an attractive energy source (Nova Scotia Department of Energy, 2011b).

The wind farms in Canada have a capacity of 5,265 MW -- enough energy to power over 1 million homes, or about 2% of Canada’s total electricity demand. In Nova Scotia there is a 285.6 MW capacity (Canadian Wind Energy Association, 2012). There are various sizes of wind turbines which have the power to generate various amounts of energy. Wind turbines are divided into two categories and referred to as small wind and big wind. The technology, cost, site selection, and energy generation capabilities differ for the two. The size of the turbines depends on the goals of the project.

Completing a wind project is a multi-step process. Applicants must consult with various levels of government and community members including: obtaining permits; conducting wind, environmental, economic, and financial assessments; land acquisition and site design; and finally site preparation (Canadian Wind Energy Association, 2012). It is important to remember that despite its appealing features, wind energy production is limited to the length of time, place, and intensity of wind (Botkin, Keller, & Heathcote, 2006). Selecting a location that receives high wind speeds frequently is essential for harnessing any substantial amount of energy (Canadian Wind Energy Association, 2012).

Wind turbine location is limited by the proximity to available connection lines and how much energy capacity is available at each location. In Nova Scotia, wind turbines are often located on leased or purchased land located outside of communities due to setbacks and regulations. In order for the project to be feasible, site location in coordination with available energy capacity and access to connection lines must be taken into account.

Dalhousie University is an urban campus; consequently; zoning regulations would prevent the installation of wind turbines on the campus. As a result, Dalhousie would be required to purchase or lease land outside of their community in order to develop a COMFIT wind project. The study was designed to explore the location options and requirements for a successful project.

There are many considerations, such as energy type, scale, and suitable location that are considered when engaging the COMFIT program. The overarching purpose of these decisions is to create a project that will yield maximum environmental, economic, and social benefits. For example, enabling Dalhousie University to fulfill its sustainability commitments and meet greenhouse gas reduction targets is an important aspect of a COMFIT project.

### 2.6 Dalhousie University's Campus Energy Master Plan

In 2012, Dalhousie released a Campus Energy Master Plan as a guide for future development of the energy infrastructure at the University in a manner consistent with the Climate Change Plan. Part of this plan addresses the need for energy security, which implies “access to a stable supply of affordable energy from sources acceptable to Dalhousie.” (MCW Group, 2012, Section 2.2) This includes developing renewable energy and other local sources of energy to reduce GHG emissions - an extension of the objectives in the Universities Climate Change Action Plan. The Campus Energy Master Plan examines options for various renewable energy sources including off-site wind production. For Dalhousie to participate in wind production, it would have to be off-site due to the Halifax Peninsula Land-Use By-Law (MCW Group, 2012). Under the COMFIT program, there are two categories for wind production: large-scale (2 MW installed or greater) and small-scale (less than 2 MW installed) (MCW Group, 2012). The plan states for a large wind production:

> While these projects present strategic importance to Nova Scotia's and Atlantic Canada's energy future, it is unlikely that the University would be a major developer/co- developer of this kind of project. Minor shareholder/stakeholder involvement may be considered to provide access to wind power facilities for research purposes. (MCW Group, 2012, Section 7.2.3)

The plan indicates that small-scale wind production may be a more likely endeavor for the University:

> Active involvement by the University in community-scale wind projects would address its carbon neutrality and clean energy supply objectives and needs, support community initiatives, and provide a unique venue for leadership in energy research and education. The University will also benefit financially from the moderate ComFIT electricity rates. (MCW Group, 2012, Section 7.2.3)

The Campus Energy Master Plan addresses the opportunity for Dalhousie to participate in the COMFIT program (MCW Group, 2012). The COMFIT program provides Dalhousie with the opportunity to take action to achieve these objects and to reflect their commitment to "exercise leadership by reducing emissions of GHGs in collaboration with our communities" - part of their pledge when they signed the University and College's Climate Change Statement (University of College Presidents' Climate Change Statement of Action for Canada, n.d.).

### 2.7 Renewable Energy and Universities

There are a wide-range of opportunities for Colleges and Universities to engage in renewable energy generation. Generating renewable energy enables Colleges and Universities to reduce their fossil fuel consumption, offset their campus' carbon footprint, stabilize and reduce energy costs, lead-by-example, engage faculty expertise, and provide a variety of hands-on, interdisciplinary research and learning opportunities to students in the multi-step process (MIT Energy Research Council, 2006).

Wind power is a viable energy alternative to fossil fuels. It generates much lower emissions and creates far less water and air pollution and waste from its distribution than non-renewable energy sources (Melloiversity, 2008). Colleges and universities across North America are using renewable energy to help achieve their broader campus sustainability goals. The benefits to universities and colleges of integrating renewable energy include lower energy costs, reduce emissions, support education and research, and be leaders in sustainability (American Wind Energy Association, Slippery Rock University 2007).

There are wide ranges of ways in which universities have been integrating renewable energy into their operations. Many renewable energy technologies have been used, including solar, geothermal and wind energy technologies. Studies have been done on campuses to determine the combinations of strategies and renewable energy technologies that can be used to reduce GHG emissions at the lowest cost (DeBaillie, 2009). The production of renewable energy can be dependent on a variety of factors, including cost, project goals, location of the campus, and applicable policies and incentives in the jurisdiction (Lydersen, 2012).

Renewable energy projects can occur on- or off- campus. Wind energy is becoming an increasingly popular way for institutions to participate in renewable electricity generation.

On- and off- campus wind turbines are one renewable energy option that institutions have implemented. Wind energy gives colleges and universities the opportunity to generate revenue that can be used to fund other sustainability initiatives (Melloiversity 2008). Renewable energy projects at North American colleges and universities have been financed through a variety of sources including: Endowments, Gifts & Grants, Utility & Government Incentives, Revolving Loan Funds, Clean, Renewable Energy Bonds, and Student Fees (Melloiversity, 2008).

Endowment funds refer to money or other financial assets that are donated to universities or colleges. The donations are managed to provide a permanent source of income to support the teaching, research, and public service missions of institutions. Colleges and universities have increasingly been investing endowment funds in renewable energy and have been been using the revenue generated from the renewable energy projects to fund other sustainability initiatives. (Melloiversity 2008)

Gifts and grants from alumni, foundations or private companies can be a primary source of funding for smaller-scale wind projects (Melloiversity 2008). These gifts and grants can cover the start-up costs for projects or can be matched by the University to reach the total cost. Government incentives differ widely among jurisdictions and can include rebates, tax breaks, feed-in-tariffs and grant or loan programs.

These programs can make renewable energy projects more financially viable. Different jurisdictions provide different incentives and/or tax credits for wind turbine development. A revolving loan fund is a financing option that involves setting aside an initial sum of money, and using that money to finance projects that have a monetary savings or return. (This includes renewable energy projects but can also include energy efficiency or energy conservation initiatives). The revenue generated from the project is then used to fund more projects.

Student fees can be used to support renewable energy projects. A fee increases to support specific projects such as a renewable energy project are often used at universities and colleges.

Colleges and universities can integrate all aspects of a wind turbine project into institutional teaching, research, and community outreach. Students can gain hands-on experience and create positive impact on the local community (National Wind Coordinating Collaborative, Melloiversity, 2008).

North American colleges and universities have been integrating renewable energy generation into their classrooms and research. Purdue University (Indiana) installed multiple wind turbines and is researching how they interact with one another. The Milwaukee Area Technical College in Mequon (Wisconsin) installed a turbine that was expected to generate 8 percent of the campus' electricity and be used to teach students in their energy engineer and operations sustainability certifications (Kertscher, 2009). The University of New Brunswick is involved in research projects surrounding wind energy technology (Sustainable Power Research Group, 2006).

These examples illustrate some the many ways in which renewable energy can be a part of a University's operations. Dalhousie University has an operating and endowment revenue of $391.8 million and generally increasing year to year. This money is spent and invested in a variety of ways and could potentially support a COMFIT project (Dalhousie, 2011).

A group of Dalhousie Engineering students formed a group called Sexton Energy Ethics and are building a 1kW wind turbine. The turbine is directly connected to a home's electrical system and will generate power for that home. This was not directly related to any course work but was formed out of personal interest and environmental concern. (Sexton Energy Ethics, 2012) This shows the interest amongst Dalhousie Students in developing skills that will be applicable in the growing renewable energy economy.

**3.0 Case Study - Cape Breton University's COMFIT Project**

It is important for any developing program or one looking to make new steps to research and investigate those previously done by others. For the purpose of learning more about sustainability initiatives done by other universities for our for our research project, our group has looked to Cape Breton University's – Verschuren Centre for Sustainability in Energy and the Environment (CSEE). The Official opening of CBU's Centre for Sustainability in Energy and the Environment was Friday, November 4, 2011. The opening of the Centre placed CBU on the map as far as sustainable initiatives are concerned.

The school is very motivated towards sustainable action, with an ultimate goal of becoming North America's first energy efficient campus. With the overall campus neutrality in mind, the school has broken the research themes into four categories: mine water management, environmental remediation, clean carbon energy, and renewable energy. Targeting all appropriate sustainable fields for the school will allow them to utilize clean and renewable technologies with an advanced energy management system and therefore produce surplus electricity which will be sold to create revenue.

CBU's most recent action made their school very appropriate for investigation for our group project. Their sustainable action program was recently approved for a 5.4 MW CBU Wind Farm which will be located in Gardiner Mines directly across from Cape Breton University and near Nova Scotia Power's Victoria Junction Sub-station. Their project went through the COMFIT application as well, which gave insight to possible fore comings for Dalhousie University. The project was jointly developed by Cape Breton University and Cape Breton Explorations (CBEX), with land being contributed by Enterprise Cape Breton Corporation. This action supports CSEE's goal to find advanced and sustainable solutions for energy and environmental issues through research, innovation and partnerships.

The support for the program and windmill project came from throughout the community and school itself. H. John Harker, LLD. President and Vice-Chancellor Cape Breton University says: "For CBU, just as Tradition and Innovation go together, so must Energy and the Environment. It's already happening, on our campus and in our community." Purdy Purdy Crawford. LLB Counsel, Osler, Hoskin & Harcourt CBU Shannon School of Business Advisory Board Member says: "There's not a better time for corporate Canada to step up and meet the environmental demands of Canadian consumers. It's time to invest in environmental research, approach business in an environmentally friendly way and respond to continuing environmental concerns."

CBU is in a similar position to Dalhousie as a Nova Scotia based University attempting to make sustainable practices a reality. As both schools have a centre dedicated to sustainable action and being in a similar position, we must learn from others. Seeing the action taken by CBU is one to look up to. The implementation of our own windmill will help Dalhousie reach our own goals but we should also aspire to those set forth by others.

Dalhousie University can learn many things from the initiatives taken by CBU in order to become a more sustainable campus. CBU's overall goal of becoming an energy efficient campus is an ideology that Dalhousie could implement. The construction and operation of a wind turbine should therefore be an accessory to helping Dalhousie achieve their goals for reducing their GHG emissions targets. Producing renewable energy through a turbine will help offset Dalhousie's energy consumption and could fund more green initiatives for the school. Just as important, the entire CBU community is in support of their efforts to become a sustainable campus, we can learn that supporting these initiatives does make a change. Seeing all of their projects, at their campus, from wind to tidal, we every effort we can make will help the environment and make Dalhousie a better institution because of it.

## 4.0 Methods

### 4.1 Overview

In this study we have taken an exploratory approach using semi-structured interviews to collect and analyse qualitative data. The intention of the project was to gather the necessary information and resources to serve as a precursor for Dalhousie University's Office of Sustainability to pursue subsequent action towards the development of a COMFIT project. Our primary method of research was interviews, conducted with knowledgeable parties and potential stakeholders.

Prior to contacting interview participants, preliminary research about the COMFIT program, renewable technologies, and similar projects was conducted. Initial research was procured from reliable organizational and governmental websites, as well as peer-reviewed journal articles. Review of this information precipitated clear project objectives for the next phase of the research. Furthermore, in order to create a comprehensive report, preliminary research indicated that the location, specific technology, potential partnerships, social and cultural implications, and funding and budgetary concerns must be addressed. Subsequently, the majority of the project was spent collecting qualitative data in the form of research interviews.

Interviews were semi-structured; guiding questions and essential topics were established beforehand, but the interview allowed the opportunity for additional queries and/or topics to be discussed (Gibbs, 2011). The project engaged an active interview style allowing for an open flow of information between the interviewer and the interviewee (Holstein & Gubrium, 1995).This style of interview is considered more conversational as opposed to a strict question and answer structure (Holstein & Gubrium, 1995). This approach was particularly important when partnership interviews were conducted, because we found value in giving space to potential partners to explain their perspective on a proposed wind energy project. Increased flexibility allowed for a personal connection, which is important for partnership and relationship building. In addition, all meetings were multi-interviewer with a minimum of two researchers present at each meeting.

## 4.2 Interview Procedure

### *4.2.1 Participant Selection and Criteria*

Participants were selected intentionally and strategically for this study. Potential interviewees were identified using two methods:
1) During the preliminary research potential interviewees were identified for the project. People with pertinent knowledge, experience, and decision-making power were recognized and their contact information was obtained.
2) Secondly, project supervisors, Rochelle Owen and Wayne Groszko, were able to provide additional contacts for potential interviews from their own knowledge and networks.

A complete list of potential participants and their corresponding contact information was compiled and sub-divided into five broad categories: financial, administrative, technological, partnership opportunities, and COMFIT applicants. This information was organized into an excel spreadsheet and shared among the research team using Google Docs (Please refer to Appendix A). Categories of potential interviewees were delegated to individual researchers to contact.

### *4.2.2 Contacting Participants*

Research team members contacted the participants they had been delegated using the pre-determined e-mail structure. If no response was received within a couple days the participants were contacted by telephone using the established introduction from the ethics form. If the contact was interested and available for an interview, an appointment was scheduled at the interviewee’s convenience. Interviews were conducted in person or using the telephone depending on availability and convenience.

*4.2.3 Conducting the Interviews*

On the day of a scheduled interview, the interviewers convened prior to meeting with the participant to review their topics, questions and delegate tasks. A primary speaker was pre-determined to lead the interview. Remaining interviewers adopted supportive roles. Supportive roles included: note-taking, watching the time, and identifying areas that required more clarification or elaboration.

*4.2.4 Follow-up*

All participants were sent thank-you messages for their contribution to the study. In some cases, additional information on the project, updates, and de-briefing material was provided.

## 4.3 Data Coding

Preceding the interview, the note takers were responsible for reviewing and posting the information on Google Docs. These notes were organized questions and topic headings that had been created prior to the interview. Additional information was organized under new question and topic headings before being posted. Once posted on Google Docs, the qualitative data was available for all researchers to review for discussion at the next group meeting.

From the consolidated information key areas of consideration for a Dalhousie University COMFIT project were determined and presented in the results section of the final report.

## 4.4 Design Evaluation

Interviews, both in-person and telephone based, were determined to be the most beneficial method of conducting an exploratory research project. Survey and questionnaire methods, as well as more traditional methods of research were also considered. Nevertheless, the flexibility, value of personal connection, and access to immediate responses and up-to-date information (Gibbs, 2011b) far out-weighed the cost and time savings of alternative methods. Ultimately, interviews were determined to be more advantageous despite some disadvantages.

Interviews have the benefit of being flexible in terms of time, location, duration and even content (Gibbs, 2011b). Moreover, people interview each other informally everyday as a means of communicating information (Gibbs, 2011a) making it a natural form of collecting data. Additionally, interviews conducted in person have an oral dialogue as well as a non-verbal dialogue that can also be information in its own right (Rochelle Owen, personal communication, February 5th, 2012). Oral and non-verbal information comes in at real time through the interview process. Furthermore, interviews allow for immediate response and clarification. Subsequently, misunderstandings about the meaning or interpretation of questions can be mitigated, unlike with a questionnaire or survey, where the interviewer is not present (Rochelle Owen, personal communication, January 24th, 20012). Ponterotto (2006) explains that the experience of an interview gives researchers the ability to obtain a 'thick description' of a particular situation. As a result of being able to read people and extract information, a holistic and meaningful interpretation can be derived from the interview process. This was beneficial to the research project because, in the end, the procured data had to be synthesized into comprehensive vision for a Dalhousie University COMFIT project.

### 4.5 Disadvantages of Interviews

Despite an overwhelming number of advantages the interview method can pose some difficulties and challenges. Interviews are not a systematic methodology; they cannot be identically replicated as with other types of experiments (Gibbs, 2011b). Especially in the instance of a semi-structured interview, if the interview were re-conducted, it would be different. The data that is extracted from the interview can be hard to analyze, synthesize, and interpret. Interviewers need to take appropriate measures to ensure they are able to obtain maximum benefit from the interview. Consequently, multi-interviewers were able to devote their time to taking notes and observing and interviews were recorded when allowed. However, having a recorder (or even an interviewer) present is sometimes regarded as a barrier in data collection because it can make the participant nervous and act as an impediment to their openness (Rochelle Owen, personal communication, February 7th, 2012). In contrast, some of the interviews will be conducted over the phone, potentially removing this barrier. Lastly, interviews are generally considered a costly and time consuming way of accumulating information (Gibbs, 2011a). Nevertheless, the costs and disadvantages are considered less significant than the benefits of the interview method.

### 4.6 Limitations and Additional Considerations

The project had several limitations that were considered and managed. Four of the major limitations and concerns were time, resources, lack of experience, and personal biases.

The project was conducted over one term, three months, as part of the requirements for Dalhousie University's ENVS 3502 course. Moreover, the research team was subject to project deadlines throughout the term that were outlined on the course syllabus and imposed by the instructor. As a result, the preliminary proposal, data collection and analysis, the report, and the presentation of the findings were allocated specific amounts of time to be completed. For efficiency, the team's supervisor and client provided support in the establishment of an appropriate project scope. For example, under Wayne Grosko's expert advice the project was scoped to wind energy. In order to work within the time limitations the research team had to maintain organization and steadfast commitment for the duration of the study. The research team met weekly with Rochelle Owen, the project supervisor and T.A. John where updates and feedback were given. The team also met approximately bi-weekly with Wayne Groszko, the project client, to maintain progress updates and ensure success. Additionally, the research team met regularly and shared information via a Facebook group, Google Docs, school e-mails, text message and a shared e-mail account.

In addition to time constraints the project team had to work with limited resources and no prior experience as interviewers. The project was limited by the availability and willingness participation of the identified contacts. Furthermore, geography constraints limited some interviews to the telephone. The project team developed a multi-interviewer strategy that allowed for information to be obtained efficiently and effectively. The structure of an active interview provided the researchers with the flexibility to explore ideas and converse more informally with the interviewees (Holstein & Gubrium, 1995). This structure reflects how people interact in regular society; therefore, the research team could feel more at ease having had experience with the inherent 'interview nature' of our society (Gibbs, 2011a). Subsequently, the data was analyzed and made the best use of the available data to draw reliable and reasonable conclusions. In situations where resource and experience limitations were more difficult to manage the aid of the team's supervisor and client was able to compensate for the researcher's short-comings.

Lastly, as environmental science and sustainability students, who would like to see more environmentally friendly projects developed, the importance of remaining impartial had to be addressed. According to Lois M. Haggard's *Health Surveys and Social Science: A Primer for Applied Survey Projects,* "Qualitative research relies almost entirely on open-ended explorations of people's words and thoughts" (Haggard, p.11). She suggests that this can be done in many ways, including interviews, but that it is key to remain impartial. To mitigate this concern Gibbs (2011c) emphasizes focusing on building rapport and looking for opportunities to see mutual engagement. The interview process is about collecting information, not determining whether or not the research agrees with the data (Gibbs, 2011c).

## 5.0 Results

The information gathered from the interviews was compiled into six categories that are relevant to decision-makers considering a COMFIT project of this magnitude:
5.1 Project scale
5.2 Project finance
5.3 Partnership models
5.4 Project locations
5.5 Student engagement opportunities
5.6 Application process

### 5.1 Project Scale

*5.1.1 Small Wind vs. Big Wind*

Wind projects can vary in scale from a single small wind turbine (less than 50 kW) for personal use to industrial scale wind farms with large commercial-scale turbines that can be 120 metres high and capable of producing 2 megawatts of power (enough electricity for about 600 homes) each. (Nova Scotia Department of Energy).

Under the COMFIT program project scale has been divided into two categories, small wind and big wind. Small wind is defined as turbines with a capacity and output of 50 kW or less at a wind speed of 11m/s with a swept area of 200m2. Big wind is defined as turbines with a capacity greater than 50 kW at a wind speed of 11m/s. The rate that Nova Scotia pays for the power produced depends on the project scale. Along with the size of the turbine, the number of turbines is a factor in determining scale. A wind project can include one turbine or many turbines on a site. The size of the turbine may also have an effect on zoning regulations in proximity to residential communities. A large scale turbine requires a 1000 meter setback from residents whereas a small scale turbine can usually be used in urban settings.

The objectives Dalhousie has for a COMFIT project will be a factor in determining the scale of the project. The objectives that could influence the scale of a project include research and student engagement potential, GHG emissions offset potential, and economic gain.

Having a large turbine will produce more energy, and therefore will result in a larger economic gain while reducing a larger portion of Dalhousie's GHG emissions. There is a higher cost associated with large turbines, and the interviews revealed that finding suitable land for a large turbine within the HRM was difficult. There is greater flexibility over where a small turbine can be placed, and therefore finding a site suitable for learning opportunities and student engagement may be easier for a small scale project.

**Table 2:** A comparison of small and big wind to assist in determining project scale. Small wing and big wind can range in size. For calculation purposes the small wind example represents 50 kWh and the big wind example represents 1 MWh.

| | **Small Wind** | **Big Wind** |
|---|---|---|
| **COMFIT Rate** | 49.9¢ per kWh | 13.1¢per kWh |
| **Cost** | Approximately 5-6 dollars per watt; as such, a 50 kWh turbine would cost approximately $250,000. | Approximately 3 dollars per watt; as such a large turbine would cost $3,000,000 per MW. |
| **Annual Revenue** | $54,640.50 | $54,640.50 |
| Payback Period | 4.58 years | 10.46 years |
| Annual Return as a percentage of total project cost | 21.9% | 9.56% |
| Percentage of Dalhousie's Energy Consumption produced by wind turbine(s) | 0.17% | 3.44% |
| **Impact** | A small wind project could potentially have more opportunities for participation and engagement from students as well as research opportunities. | A big wind project would generate a larger amount of power, and therefore reduce Dalhousie's GHG emissions by a greater amount.<br>A big wind project could be much more impressive in terms of social, psychological and cultural impact on the Dalhousie community because of its scale and contribution to meeting Dalhousie's GHG emissions reductions targets. |

| | | |
|---|---|---|
| **Location** | Generally zoning regulations throughout the province require less setbacks than for Big wind and therefore it is feasible to have a small wind project in the HRM. | Zoning regulations within the HRM require a 1km setback for large wind projects. According to interview participants these regulations do not permit big wind turbines in the majority of the HRM. A big wind turbine would most probably be located outside of the HRM. |
| **Application process** | Zoning regulations do not require large setback. Can be achieved within urban settings.<br><br>Does not require as much upfront cost or materials as big wind.<br><br>Does not require a full Environmental Impact Assessment; furthermore, the timeline for the project is significantly shorter. | A project of this scale requires much more time for Environmental Assessment.<br><br>The execution of a larger project involves the risk of upsetting surrounding communities, like the opposition seen in Pugwash, NS.<br><br>Zoning regulations require a 1000 meter setback from residential areas - not feasible for NS rural areas. |

Ultimately Dalhousie must decide on its objectives and budget for the project and this will inform the decision of the scale of the project.

### 5.2 Project Finance

Financing a wind project requires a significant upfront capital investment. As specified by Lukas Swan, a small wind turbine costs about five to six dollars per watt; as such, a 50 kwh turbine would cost an estimated $250,000. Additionally, Lukas explained that a larger turbine costs about three dollars per watt, meaning that a large turbine would cost approximately $3, 000, 000 per MW.

*5.2.1 Financing*

According to the majority of interview participants, financial equity and the ability to secure a low interest loan are the most important things Dalhousie can offer to a COMFIT project. Many wind CEDIFs and community groups are relatively small and new. As a result, they can struggle in obtaining bank loans and low interest rates on loans. Dalhousie is an established institution with a large amount of capital and equity, and therefore could potentially secure a lower interest rate and therefore be a beneficial financial partner in a COMFIT wind project.

Dalhousie could directly invest the money it holds (from pension and endowments, etc.) into a wind project. Alternatively, Dalhousie could also be an asset in raising the finances indirectly by leveraging its vast network of connections and contacts in the community. For example, Dalhousie could leverage its contacts and connections with faculty, staff, alumni and community members to reach potential investors in a wind CEDIF.

*5.2.2 Community Economic Development Investment Funds (CEDIFs)*

CEDIFs are a pool of capital that is raised through the sale of shares, and is managed to operate or invest in local initiatives. They are a well-developed tool for generating capital that has enabled communities to participate in the COMFIT program. The fund effectively raises the money to begin the project, which helps the developer, but also encourages community engagement. Reasons for a potential shareholder to invest in a CEDIF could involve anticipated economic gain, ecological concern, or desire to participate in community development.

CEDIFs are considered an eligible community under the COMFIT program, and can be formed in order to raise the equity required to finance a project and to apply for projects.

Financing a COMFIT wind project is very costly; however there are programs such as a CEDIF to raise funds. Dalhousie could form a partnership with an existing CEDIF on a COMFIT application or start a CEDIF that it would build to finance a wind project. The opportunity for investors to receive an immediate tax credit on their provincial taxes for investing in a CEDIF was consistently identified as a good opportunity for raising the equity required for a project.

*5.2.3 Partnerships with Developers*

From the interviews it was revealed that the typical arrangement for community applicants to finance their projects is to enter into a relationship with a developer. This relationship can take the form of a Joint Venture Company or a Limited Partnership. Forming a partnership with a developer is a means of splitting the initial equity costs to finance a COMFIT project. Moreover, the knowledge of the developer is an important asset because they have experience with the COMFIT program. Further, many community groups do not have the capital or security to receive debt-financing for their projects and need to partner with an entity that does.

The COMFIT directives require that the eligible entity must have 51% of the decision-making power. The developer that partners with the eligible community can have up to 49% of the decision-making control. This is discussed in greater detail below.

*5.2.4 Challenges*

Similar challenges were identified between the applicants that were interviewed. Obtaining enough equity for the project to go forward was consistently identified as a challenge. As well, acquiring suitable land was consistently identified as one of the more challenging steps in the COMFIT application process.

Finding investors for a CEDIF to reach the $250,000 minimum in each offering was identified as a challenge. Participants identified lack of awareness and marketing as a reason for this. The fact that many community groups are volunteer run and can lack the marketing expertise was also identified as a reason.

Issues of legal risk management and regulations were identified in one of the interviews which must be taken into consideration before the start of the project. Following the process as laid out in the COMFIT application, legalities must be met before installation.

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## 5.3 Partnership Models

From the interviews we learned that the typical arrangement for community applicants to finance their projects is to enter into a relationship with a developer. This relationship can take the form of a Joint Venture Company or a Limited Partnership. The reason for forming a partnership with a developer is that the developer brings the financial equity required to fully finance the project. Further, many community groups do not have the capital or security to receive debt-financing for their projects and need to partner with an entity that does.

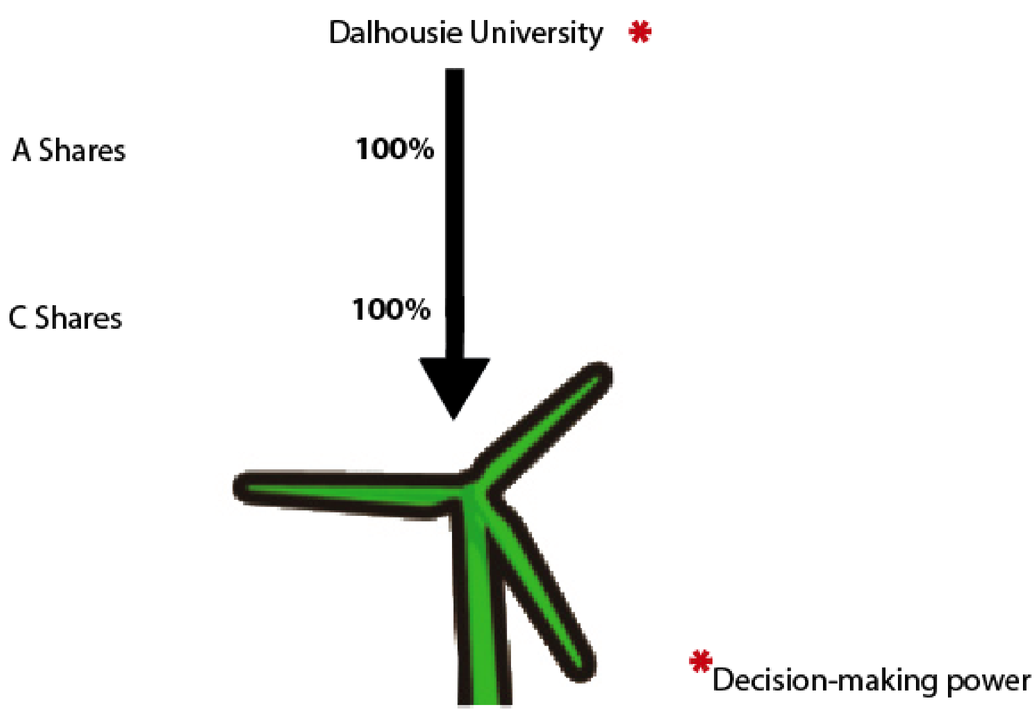
The COMFIT directives require that the eligible community applicant must have 51% of the decision-making power. The developer that partners with the eligible community can have up to 49% of the decision-making control. These control shares are called C Shares or Control Shares.

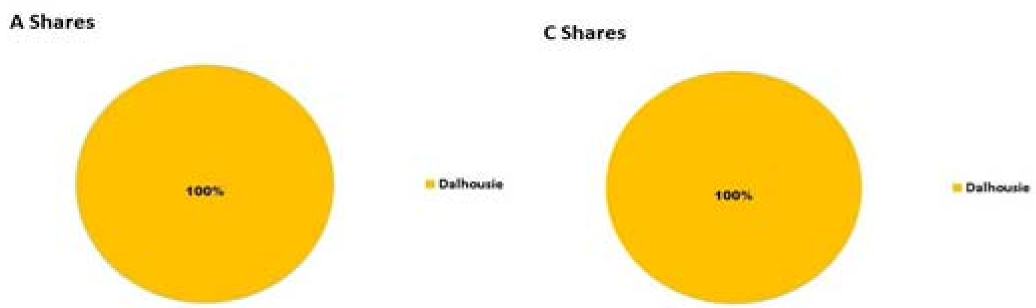
This is seen in practice when a Board of Directors is formed for a project. Members can come from both the developer and the eligible community, but members from the eligible community must always represent the majority in order to maintain their decision-making power.

In addition to the minimum requirement for Control Shares, COMFIT directives require that the eligible community hold 20% of the A Shares which means that they put forward 20% of the financing and receive 20% of the profit from the project.

The interviews revealed four different models for partnerships for Dalhousie in a COMFIT project which are presented below.

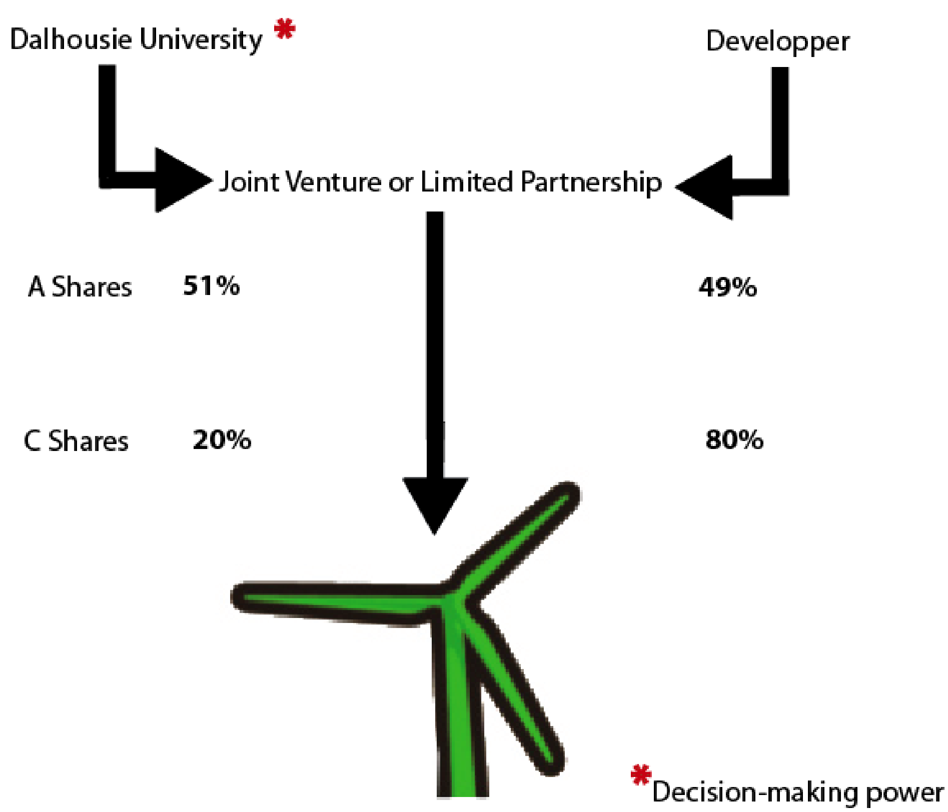
**Option A**

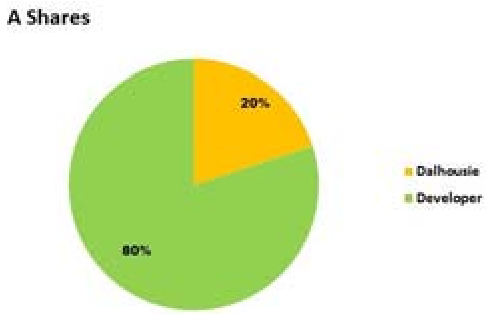


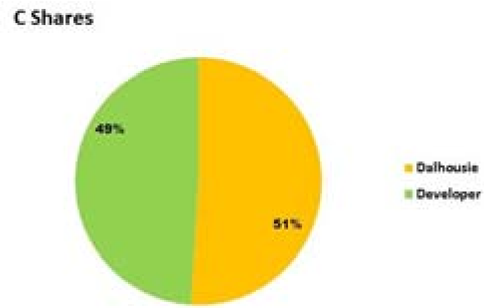



In Option A, Dalhousie applies for a COMFIT project independently. This means that Dalhousie would be responsible for all the capital investment and would receive all benefits from the project.

**Option B**

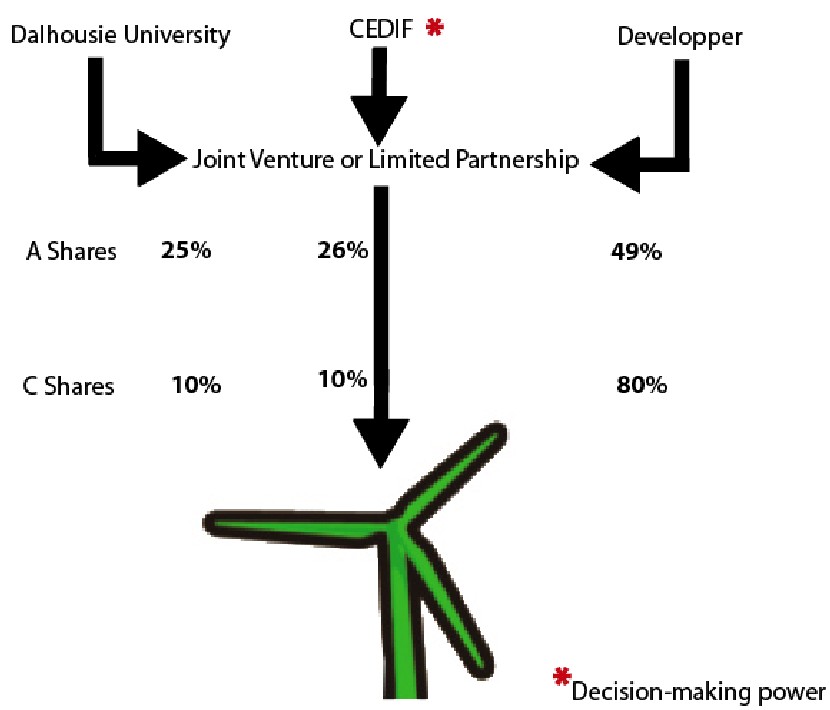


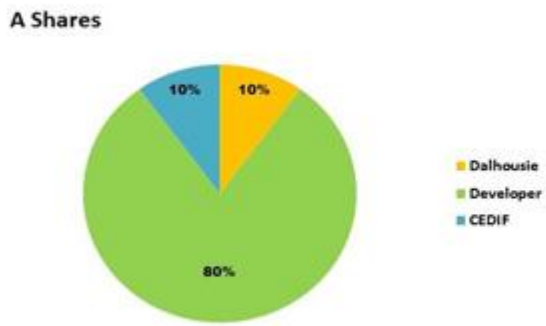


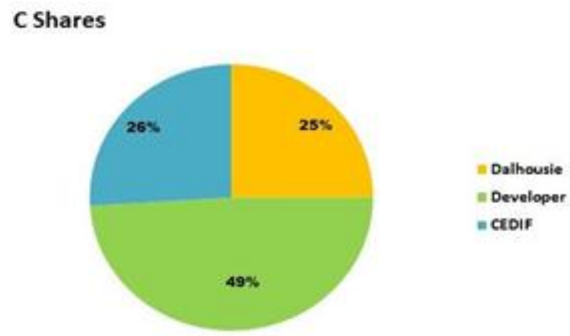




In Option B, Dalhousie partners with a private developer. In this option the University provides 20% of the start-up costs and a developer invests the remaining costs. The profits are proportional to the investment The decision-making or control of the project is split so that Dalhousie has 51% Control Shares and the Developer has 49%.

**Option C**

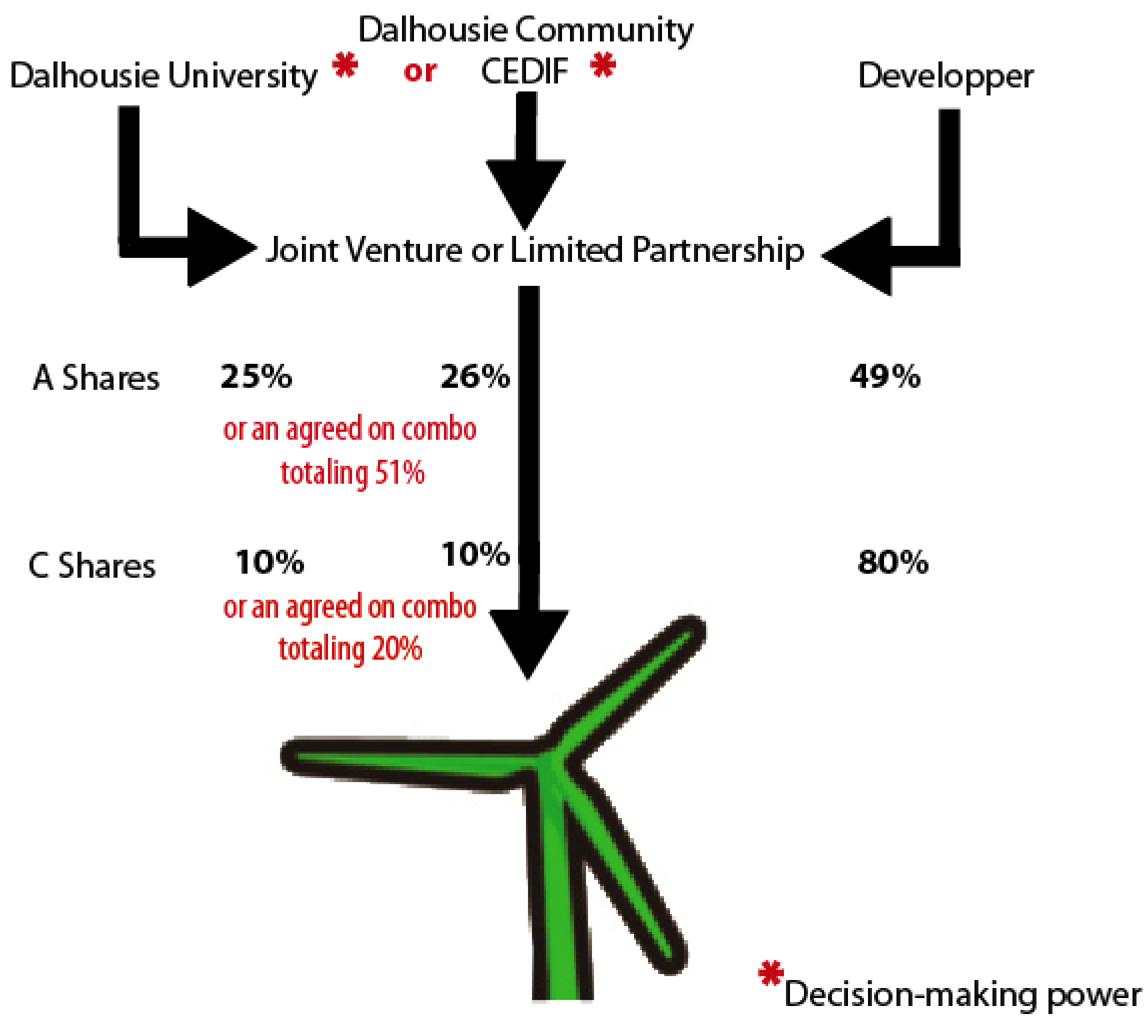





In Option C, Dalhousie forms a partnership with a developer and another eligible community (such as a CEDIF). Dalhousie and the other eligible community split the 20% investment, which reduces the initial investment for both communities. The two communities also split the profit and the 51% of the decision-making Control Shares. The developer maintains an 80% financial investment and 80% returns as well as 49% decision-making power.

**Option D**




Option D is similar to Option C except that Dalhousie starts a CEDIF that could draw on Dalhousie's connections to staff, faculty, alumni and community members in order to drive investment in the project. Dalhousie and the Dalhousie CEDIF split the investment and the decision-making control in an agreed on combination, as long as it totals the required 20 and 51% respectively. A developer maintains 80% financial investment and 49% control.

In all the above options, the construction, operation and maintenance of the project are typically contracted out to a company who specialises in wind turbines. Student engagement in the process is discussed below.

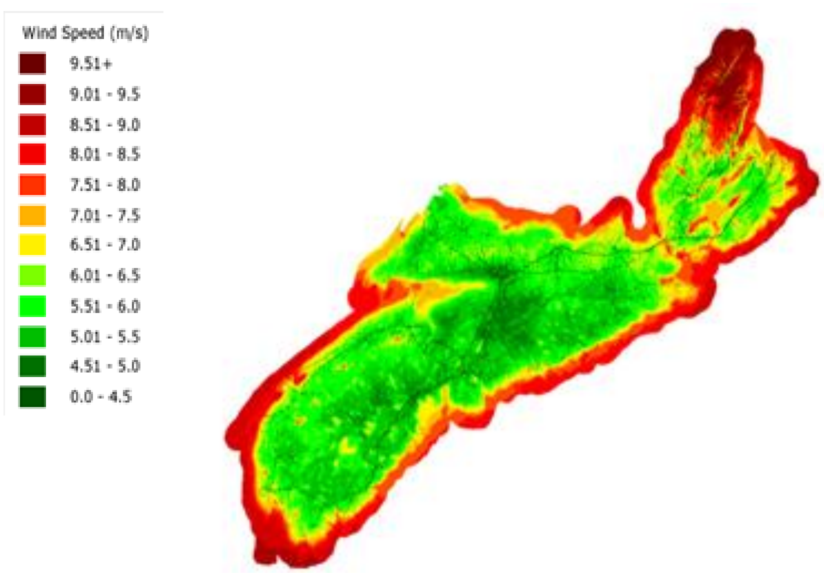
### 5.4 Determining Location

Dalhousie University cannot have a wind project on-campus because their three campuses are in an urban setting and because of zoning setback requirements. COMFIT eligible entities do not need to put their project on their own property, and commonly lease or buy land to build their project.

The interview participants consistently identified the fact that the new wind by-law in the HRM make big wind turbines unpermitted in many parts of the HRM. As a result, the interview participants identified that if Dalhousie participated in a big wind COMFIT project that it would most likely would be located outside of the HRM.

Within Nova Scotia, the most ideal winds are generally along coastal areas and mountain ranges. These areas receive the highest quantity and strongest wind within the province (Nova Scotia Department of Energy Wind Atlas).

**Figure 2** This map demonstrates the wind resources of Nova Scotia at 50m above ground. It can be seen that coastal regions have highest wind velocity (Nova Scotia Department of Energy).




Dalhousie does not currently own land within these areas, and therefore would need to acquire land through purchase or partnership in a suitable area. David Swan stated that an annual average wind speed of approximately 6 m/s was required to support a wind project. Kenneth Corscadden explained that choosing a location with maximum wind resources is important for the greatest economic benefits.

Generally speaking, an economically attractive project will be located where the wind speed is sufficient to yield a 33% capacity factor from the turbine. The capacity factor is the percentage of the total output capacity that is actually generated on an annual average basis.

Krystal Therien was able to elaborate on additional considerations for site location. Krystal explained that COMFIT applicants must consider access to the site. In some circumstances, applicants will need permission from adjacent property owners to access the project site or to connect the electricity to the grid.

### 5.5 Student Engagement Opportunities

The participants in the study had varying opinions and attitudes toward the possibility of student involvement. Krystal Therien presented the idea of Dalhousie could create a 'soft benefits package' with a potential partner. Moreover, the benefits can include educational experiences for students, for example, hands on experience with wind technology.

The other participants viewed student engagement as a great benefit to such a project. Such benefits can be possible reduction in costs and attraction to new students for a work experience course.

For students the turbine would be a great research opportunity. Students can be involved from the initial phase of the project by monitoring wind speeds among other things. After the project is installed they can collect data. Hands on work experience could be fostered from many fields of study. The money generated from the turbine could then be used to pay for student research and scholarships, which could provide benefits for many years.

### 5.6 Application Process

There is an application process that Dalhousie and its potential partners will have to complete in order to obtain approval from the Nova Scotia Department of Environment for the project to proceed. It was identified from interview participants that this process can take upwards of a year. The process has many requirements and a significant amount of planning is involved to create a successful and feasible project.

To participate in the COMFIT program, a wind project can face many challenges throughout the process including raising the required funds, securing a site, and getting approval.

The interview participants identified key challenges the project could face. The project is dependent on finding appropriate land to maximize economic gains, but must stay within the program limitations. Depending on the scale of the project, suitable land may be difficult to find. The land will need to be large enough to provide adequate space for the turbine, have access to a road, and have sufficient wind speeds.

Support for the project is a crucial element. Dalhousie University decision-makers, students, faculty and staff must support the project. Ultimately, having the support from the administration will make the project possible. Further, making connections with potential partners who have experience is beneficial.

## 6.0 Discussion

Based on the interview results, the justification for Dalhousie to participate in a COMFIT project and the considerations Dalhousie decision-makers need to be aware of for pursuing a COMFIT wind project are discussed below.

### 6.1 Feasibility and Overall Recommendation

Based on the research results, the research team believes a COMFIT wind project is a feasible way for Dalhousie to meet their GHG emissions reductions and other commitments to sustainability. The research team encourages Dalhousie to further explore potential partnerships with other eligible communities and a developer as an option to participate in the COMFIT program. This would allow Dalhousie to work with a partner or partners that have the required experience.

All of the partnership options should be explored in greater detail. Along with determining potential partnerships Dalhousie needs to determine its goals for a COMFIT project. By determining their goals and objectives Dalhousie can have a framework for making decisions of scale, site, financing, and partnerships.

### 6.2 Dalhousie's Potential Contribution

A COMFIT project is financially feasible for Dalhousie, therefore the initial investment of the project could be funded by the University. Most interview participants identified financing as an important contribution that Dalhousie could offer.

In addition to financing, Dalhousie has access to students and experts within their community who can contribute knowledge and guidance for developing a COMFIT project. Krystal Therien identified that Dalhousie students could help with a project application. In particular she identified the potential for students to complete the environmental assessment, financial plans, and marketing. Krystal Therien stated Dalhousie would be able to complete much of the process internally, however, in contrast, Wayne Stobo explained that the wind energy industry is mature and the expertise already exist. As such, he did not view the role of Dalhousie students and faculty expertise as beneficial to a COMFIT project. It would be worthwhile to explore how students could best participate in a COMFIT wind project to gain valuable experience in the growing renewable energy sector.

#### *6.2.1 Marketing and promotion*

Many of the interview participants identified spreading awareness of the opportunities for wind energy investment can be a challenge. From the interviews it was identified that CEDIFs and community groups do not always have adequate resources to promote their projects.

Dalhousie University not only has dedicated staff for marketing and promotion, but has several departments and classes where these skills are taught. The researchers agree, Dalhousie has the potential to contribute to the marketing and promotion of a COMFIT wind project.

### 6.3 Benefits to the Dalhousie Community

If Dalhousie were to be a producer of renewable energy through the COMFIT program there would be many benefits to the school and community. As previously mentioned, there are student engagement opportunities, economic gains, and environmental benefits.

A COMFIT wind project would help offset the GHG emissions produced from the University's other energy sources. A wind project can lower Dalhousie's GHG emissions and contribute to the development of a sustainable energy infrastructure in Nova Scotia.

This project would provide revenue through dividends to Dalhousie from the premium rate that Nova Scotia Power pays renewable energy producers.

The experience that students could gain from this project would be invaluable in developing their understanding of renewable energy and in building a diversity of skills that are applicable in the growing renewable energy economy.

This project could help Dalhousie live up to their commitments to leadership in sustainability, enhance the reputation of Dalhousie, and be a valuable recruitment tool for future students that value 'walking the talk' when it comes to sustainability.

### 6.4 Community Involvement & Engagement

Community is an important component of the COMFIT program. The perception and definition of community can vary, as can its implication for a wind project.

Under the COMFIT program universities, non-profits and businesses operating as CEDIFs, municipalities and First Nations are considered communities eligible to participate in the program. The wind project itself can be located anywhere in the Province that is suitable, as such the geographic community where the wind turbine is located and the eligible community that runs the project do not always overlap.

The relationship between the community that owns the turbine and the community where it is located is important for the success of a project. The community who owns the turbine should focus on fostering a positive relationship with the community where a turbine could be situated. The more the two communities overlap the more and the more the shared interest they have in the turbine the more likely the project will be successful.

For Dalhousie, a wind project would involve the acquisition of land off campus and outside an urban area; subsequently, the project would be located within another geographic community. Engagement with the community where the project is located is a requirement of the COMFIT program and an opportunity for Dalhousie to create relationships with communities in Nova Scotia. The prospective site and community would need to be approached and engaged appropriately.

The Dalhousie community is also an important consideration in the development of a COMFIT project. As previously mentioned, student engagements opportunities could exist in the form of educational experiences within a ‘soft benefits package’ with a developer. Additionally, Dalhousie becoming a producer of renewable electricity will have social, psychological, and cultural effects on the school community. The project should be thoughtfully integrated into Dalhousie’s student community in order to establish a sense of ownership and to cultivate a positive attitude towards renewable energy. A COMFIT wind project is something Dalhousie community members could be proud of.

### 6.5 Potential Partners

The recent merger of Dalhousie with the Nova Scotia Agricultural College (NSAC) opens up potential collaboration on a wind project. Based on the interview with Kenneth Corsadan, NSAC does not have land suitable for a wind project on their campus property because of the Municipal zoning regulations and the topography.

NSAC does however have connections with farmers whom they are working with to explore the feasibility of wind projects on farmland. These connections could be explored further to determine if potential sites of partnerships exist.

It was the intention of the researchers to explore more deeply potential partnerships opportunities for Dalhousie however due to difficulty contacting potential interview participants and other restraints this was not done comprehensively. The researchers recommend that future students explore possible partnership opportunities. A recommended starting point would be to connect with the Halifax Water Commission, who already has COMFIT project applications and one project approved.

### 6.6 Financing

Turbines can be built to produce a range of energy generation. For demonstration purposes an example of small wind and big wind were calculated. The small wind calculation was performed for a 50 kWh turbine project and a big wind calculation for a 1 MWh turbine project. The following compares project cost, energy production, annual revenue, payback period, annual return as a percentage, and energy production as a percentage of Dalhousie University total energy consumption. These figures are listed in Table 1 and detailed calculations in Appendix D.

A small wind turbine project would cost $250,000, or $5 /kWh. A big wind project has a cost of $3/kWh. A 1MWh turbine would be significantly more expensive requiring a $3,000,000 investment. Although a big wind project is initially more expensive, it will generate significantly more energy and revenue than a small wind turbine. Big wind will produce 2,190,000 kw and $286,890 each year, whereas small wind will produce only 5% of the energy (109,500 kW/year) and 19% of the annual revenue ($54,630.50) of big wind. The payback period for a small wind turbine is 4.6 years, compared with 10.5 years for a big wind turbine. Looking at annual return as a percentage of the project cost a small wind turbine will produce 21.9% in annual return and a big wind turbine will produce 9.6%. Big wind projects require larger investments than small wind projects, and have to undergo a longer payback period because of their smaller annual return. In the long term a big wind turbine is a better investment, because after the payback period it will generate large amounts of revenue and energy.

From an environmental perspective a larger wind project would be better because it would produce more energy. A large wind project of 1 MWh would produce 3.44% and a small wind project would produce 0.17% of Dalhousie's annual energy consumption. In order to cover a significant portion of consumption Dalhousie would need to create a large wind project. For example, if Dalhousie wanted to produce 10% of their energy consumption using wind energy we would need a 2.9 MWh project.

It is recommended by our client, Wayne Groszko that a project creating 25% of Dalhousie's energy consumption would be a great option. This project would have to be approximately 8 MW in size. It would cost $24 million and produce 17,520,000 kWh/year. This would generate an annual revenue of $2,295,120 from electricity sales.

In order to partially fund this project, Darrell Boutilier, the Director of Operations with Dalhousie Facilities Management, recommended we raise funds and apply for grants. He was excited that wind energy sales could be used to pay back the project, and suggested a third party investment could also be used for funding. In order to get a proposal for this project approved certain criteria were outlined by Darrell and Ken Burt, the Vice President of Finance and Administration at Dalhousie. Dalhousie would need to outline net present value, payback period, purpose, scope and benefits of the project, risks and how they will be mitigated, and financing options. After making an approved business plan the Dalhousie COMFIT wind project team could join with Facilities Management to approach Senior Management and Dalhousie decision makers.

## 7.0 Conclusion

It is well established that the world's dependency on fossil fuels for energy is unsustainable and harmful to the planet and future survival of humans. Taking action to switch to renewable energy sources is needed. Nova Scotia has recognized this need, and has created policies and goals to move the province away from its dependency on fossil fuels and toward renewable energy. As an outcome of these goals, Nova Scotia established the community-feed-in-tariff program. COMFIT provides the opportunity for communities (such as Universities) to generate renewable energy and receive a premium return rate for this energy.

Dalhousie University is considered an eligible community that can apply for the COMFIT program. This study sought to determine how Dalhousie could participate in the COMFIT program as a means of achieving their goals for reducing their GHG emissions, and act on their pledge to the University and College's Climate Change Statement to "exercise leadership by reducing emissions of GHGs in collaboration with our communities" (University of College Presidents' Climate Change Statement of Action for Canada, n.d.).

This study took an exploratory approach to examine opportunities and challenges for Dalhousie University to participate in the COMFIT program through wind energy. The main method of data collection was in the form of interviews. The information gathered from the interviews was compiled into six categories: (1) project scale, (2) project finance, (3) partnership models, (4) project locations, (5) student engagement opportunities, and (6) application process. The interviews produced valuable findings that demonstrated how Dalhousie can apply for a wind energy project independently or by forming a partnership with other eligible communities and/or a developer. There are a variety of options for financing the project and there are many opportunities to integrate this initiative into student learning. The project has established that Dalhousie participating in COMFIT is feasible and the benefits are numerous, both for Dalhousie's community and Nova Scotia's community.

Overall, the exciting opportunity for Dalhousie to generate wind energy as part of the COMFIT program merits further research and consideration.

### 7.1 Recommendations

This study set out to do the first exploration of how Dalhousie could participate in the COMFIT program. Based on the finding, further research is recommended to explore the partnership models in more depth, and to further explore potential partners for a project. It is also important that further research seeks to understand what the goals and objectives for Dalhousie participating in a COMFIT project are. By doing this, the scope of the project in terms of scale, financing options, and partnerships can be determined. Additionally, further research could explore how Dalhousie could manage their pension and endowment investments to support in sustainable investment options such as a wind CEDIFs, along with other financing options for the project. The research team recommends that another group of student researchers or a full-time researcher with the Office of Sustainability take on this project to conduct additional research and develop a proposal, making participation in COMFIT an exciting opportunity for Dalhousie to reduce their greenhouse gas (GHG) emissions.

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# APPENDICES

## Appendix A: Interview Participants

David Alderson, Program Development Scientist, Cape Breton University

Darrell Boutilier, Dalhousie University, Director of Operations

David Swan, Spiddle Hill Project Manager, Colchester Cumberland WindField

Ken Burt,Vice-President (Finance and Administration), Dalhousie University

Kenneth Corscadden, Assistant Professor, Nova Scotia Agricultural College

Krystal Therien, COMFIT Administrator, Government of Nova Scotia

Lukas G. Swan, Assistant Professor, Mechanical Engineering Dalhousie University

Wayne Stobo, President, Chebucto Windfields Inc.

## Appendix B: Interview Themes/Sample Questions

**Introduction:**
The purpose of this research is to determine ways that Dalhousie University could meaningfully participate in the Nova Scotia Community Feed-In Tariff (COMFIT) program. In order to answer this question our research will attempt to identify key attributes that Dalhousie could offer to a COMFIT project. We will attempt to identify

- Key attributes that Dalhousie could offer to a COMFIT project;
- Key people in the University community who are necessary to the success of the project;
- Potential partnerships that would allow Dalhousie to participate in COMFIT, and
- The benefits to Dalhousie of participating in the COMFIT program.

Additional background dependent on the interview subject:

*The Nova Scotia government has established a community-based feed-in tariff program (COMFIT) that allows communities to connect renewable electricity projects to the grid at the distribution level. Universities are considered communities by the COMFIT program definition; making COMFIT a project which presents an exciting opportunity for Dalhousie to meet a portion of its GHG emissions reductions target. However, the application for a COMFIT project is lengthy and intensive, and there is already an application queue with existing applicants.*

*The potential to partner with other organizations could present opportunities for Dalhousie to participate in the COMFIT program and significantly reduce the school's GHG emissions. This research will help decision makers at Dalhousie to understand the opportunities for participating in the program as well as how to proceed in a COMFIT project.*

**1) Partnership category**
Please describe your COMFIT project.
What stage is your project in?
What factors does/did your organization need to succeed in the COMFIT project?
What type of external support or connections did you require in order to complete your project?
How did you attract shareholders for your Community Economic Development Investment?
Fund (CEDIF)?
What were challenges you faced during the COMFIT
process?
Other comments?

**2) Finance category**
Does Dalhousie have a budget for renewable energy projects?

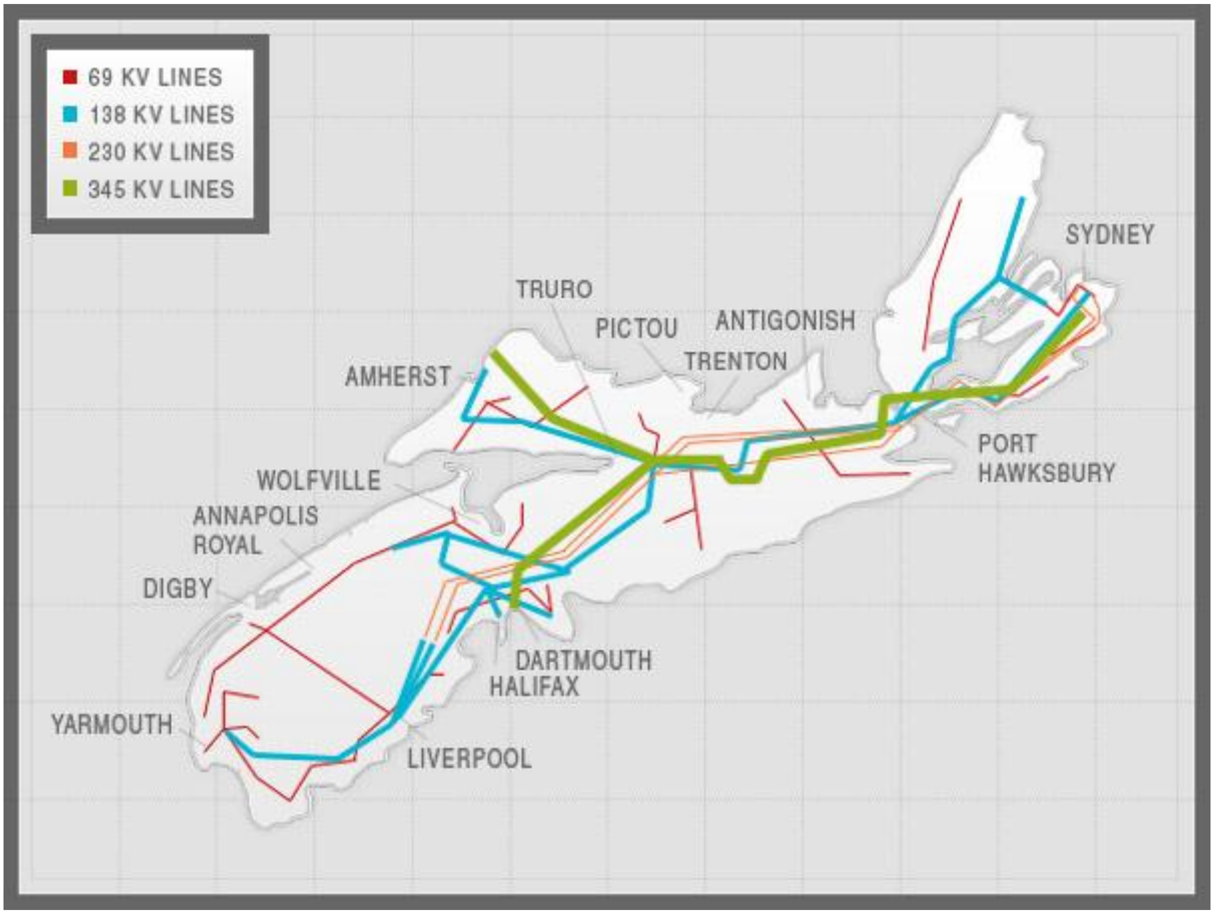
Do you think there would be interest among university financial decision makers to invest funds towards a wind turbine feeding energy into the grid through the COMFIT program?
Has Dalhousie ever partaken in a CEDIF before?
Can you speak to the feasibility of Dalhousie setting up a CEDIF and attracting investors?
Do you see Dalhousie getting involved in a project like this as a possibility in the future?

**3) Administration/Logistics category**
Can you please help us understand the steps that Dalhousie, as a university must take to participate in COMFIT?
Where is the bottleneck in the application process?
What is causing the back-log?
Where is there available space on the grid?
Are there common problems that come up in COMFIT applications?
Is solar energy likely to be added into COMFIT?
What criteria determines land suitability?
Once the application is completed and approved what is the process and timeline?

**4) Technology category**
We are the consideration for siting small vs. big turbines?
What criteria determines land suitability?
Are you able to provide cost estimates for our project? In particular we are interested in better understanding the financial differences between small and big wind turbines.
Are you able to provide us with cost information from previous, similar projects?
Once the application is completed and approved what is the process and timeline?
What technical expertise is necessary?
What technical expertise does Dal have?
What technical expertise does Dal need?

**5) COMFIT Applicants category**
What challenges did you face in your project?
What motivated you to apply to COMFIT?
What criteria determines land suitability?

**Appendix C: Map showing Transmission Lines in Nova Scotia** (Nova Scotia Power, 2012) Transmission lines are used to distribute energy throughout Nova Scotia and COMFIT projects are hooked up to the transmission lines through smaller connection lines. Choosing a site that has feasible access to both the connection and transmission lines is essential for a successful COMFIT project.



**Appendix D: Calculations**

Note: These costs do not include external costs such as land. They simply cover the cost of putting up a wind turbine. For the purpose of these calculations one small wind turbine scenario (50 kWh turbine) was chosen and one large wind turbine scenario (1 MWh turbine) was chosen. These are not the only options available.

**Figures required for calculations:**

Capacity Factors for Nova Scotia are between 0.2 and 0.4 for a wind turbine site.
We chose to use 0.25 because it is most probable.

Total Project Cost: (taken from interview with Lukas Swan)
**Small** wind turbine costs about $5/6 a watt
50 kWh = 50 000 w x $5 = $250,000
**Big** wind turbine costs about $3 a watt
1 MWh= 1,000,000 w x $3 = $3,000,000
Dalhousie energy usage as taken from the 2008-2008 Greenhouse Gas Inventory Report (page 17) Building GHG Emissions: 63,607,432 kWh

**Calculations:**

Payback period:
Small Wind (example: 50 kWh turbine)

50 kWh x 0.25 capacity factor x 24h/day x 365 day/year
109,500 kw produced in a year from 1 50 kWh turbine

COMFIT rates for 50 kW or less: 49.9¢ per kWh Wind

109,500 kW/year x $0.499 per kW = $54, 640.50 per year

Total Project Cost/ Revenue per year = payback period for project
$250,000/$54,640.50 per year = 4.58 years

Big Wind (example 1 MWh turbine):

1000 kWh x 0.25 capacity factor x 24h/day x 365 day/year
2,190,000 kw produced in a year from 1 MWh turbine

COMFIT rates for > 50 kW: 13.1¢per kWh

2,190,000 kw/year x $0.131 per kW = $286,890 per year
Total Project Cost/Revenue per year = payback period for project
$3,000,000/$286,890 per year = 10.46 years

**Annual Return**

Small: $54, 640.50 per year
Big: $286, 890 per year

Annual Return as a percentage of total project cost:
Small: $54,640.50/$250,000 = 21.9% annual return
Big: $286,890/$3,000,000 = 9.56% annual return

Percentage of Dalhousie's Energy Consumption produced by wind turbine(s)
Annual Energy produced by turbine /Annual Dalhousie Energy Consumption x 100%
Small:
109,500 kw /63,607,432 kWh x 100% = 0.17%
Big:
2,190,000 kw /63,607,432 kWh x 100%= 3.44%

**Appendix E: Recommendations for future contacts**

Further research should investigate potential partnerships with eligible communities that have experience with the COMFIT program. To start these contacts should be explored:

Jeff Knapp, Manager, Energy Efficiency, Halifax Water Commission

Jennifer Watts, Halifax City Councillor, HRM

Reuben Berge, RMSEnergy Dalhousie Mountain Wind Project

## Appendix F: Ethics Form

**ENVIRONMENTAL SCIENCE PROGRAM**
**FACULTY OF SCIENCE**
**DALHOUSIE UNIVERSITY**

**APPLICATION FOR ETHICS REVIEW OF RESEARCH INVOLVING HUMAN PARTICIPANTS**

**GENERAL INFORMATION**

**1. Title of Project:** Feasibility of Dalhousie participating in COMFIT

**2. Faculty Supervisor(s)** Rochelle Owen, Office of Sustainability e-mail: rjowen@dal.ca

**3. Student Investigator(s) Department e-mail: ph:**
Kaleigh McGregor-Bales Environmental Science kl699323@dal.ca
Kathleen Heymans Environmental Science js250974@dal.ca 902-789-2162
Meaghan Maunde Planning mg693304@dal.ca 902-471-5615
Lee Hughes Planning lz295439@dal.ca 506-261-0182
Matthew Andrews Political Science mt530764@dal.ca 902-449-7966
Quin MacKenzie Environmental Science mackenzie@dal.ca 902-880-5410

**4. Level of Project:** Non-thesis Course Project [X] Undergraduate [ ] Graduate [ ]
**Specify course and number:** ENVS/SUST 3502 Campus as a Living Lab

**5. a. Indicate the anticipated commencement date for this project:** February 8 2012
**b. Indicate the anticipated completion date for this project:** April 12 8 2012

**SUMMARY OF PROPOSED RESEARCH**

**1. Purpose and Rationale for Proposed Research:**

**The purpose of this research is to determine ways that Dalhousie University could meaningfully participate in the Nova Scotia Community Feed-In Tariff (COMFIT) program. In order to answer this question our research will attempt to identify key attributes that Dalhousie could offer to a COMFIT project. We will attempt to identify the key people in the University community who are necessary to the success of the project. We will identify potential partnerships that would allow Dalhousie to participate in COMFIT. Lastly, we will identify the benefits to Dalhousie of participating in the COMFIT program.**

This research is exploratory and will seek to expand the current understanding of how Dalhousie could participate in COMFIT. The research will attempt to answer fundamental questions that will assist Dalhousie in participating in the COMFIT project. This research will lay the groundwork for further research.

**2. Methodology/Procedures**
**a.** ***Which of the following procedures will be used? Provide a copy of all materials to be used in this study***.
[ ] Survey(s) or questionnaire(s) (mail-back)
[ ] Survey(s) or questionnaire(s) (in person)
[ ] Computer-administered task(s) or survey(s)]
[ X ] Interview(s) (in person)
[ X ] Interview(s) (by telephone)
[ ] Focus group(s)
[ X ] Audio taping
[ ] Videotaping
[ ] Analysis of secondary data (no involvement with human participants)
[ ] Unobtrusive observations
[ ] Other, specify ____________________________________________________________

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

The purpose of our proposed study is to procure valuable information and connections for Dalhousie University to engage Nova Scotia's COMFIT program.

Background research will reveal people that hold knowledge and information relevant to the research questions. These people will be contacted to request interviews. A snowball method will be used to access additional interviewees.

Information and connections will be obtained through interviews. Potential participants will be contact via telephone or e-mail and interview times will be determined. Interviewees will meet with two to three students and asked our interview questions (please refer to Appendix C for a list of these questions). Interviews may be recorded with the permission of the interviewee for further review by our group.

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

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

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

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

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

The potential participants will cover five categories:

1)Partnership
This includes organizations and institutions that could potentially enter into a partnership with Dalhousie on a COMFIT project.
e.g. Mr. Jeff Knapp, Energy Manager, Halifax Water Commission; EON Wind Electric; Virick Francis, Eskasoni Wind Energy Project; Paul Pynn, Eon WindElectric
2) Finance
This includes people that make financial decisions at Dalhousie and also people who have experience regarding financing COMFIT projects.
e.g. Mr. Ken Burt, Dalhousie Vice-President (Finance and Administration), someone who has set up a CEDIF (Spiddle Hill turbine?)

3)Administration/Logistics
This includes government representatives that deal with the administration of the COMFIT program and can answer questions on the logistics of Dalhousie participating in the COMFIT program.
e.g. Chrystal Terrian, COMFIT Director

4) Technology
This will include engineers and industry professionals who can answer questions about the wind turbine technology and how technology impacts the research questions.
e.g. Lukas G. Swan, Assistant Professor, Mechanical Engineering; David Swan, Cumberland-Colchester Windfield; Kenneth Corscadden, Nova Scotia Agricultural College

5) COMFIT Applicants
This includes people and organizations that have applied for COMFIT projects or are in the process of applying for COMFIT projects and have knowledge on the process and obstacles.
e.g. Cape Breton University COMFIT project bottom-liner; Ruben Burge, SPCA.

**c.** ***How many participants are expected to be involved in this study?*** <u>8-12</u>

**4. Recruitment Process and Study Location**
**a**. ***From what source(s) will the potential participants be recruited?***
[ ] Dalhousie University undergraduate and/or graduate classes
[ ] Other Dalhousie sources (specify) ________________________________
[ ] Local School Boards*

[ ] Halifax Community
[ ] Agencies
[ X ] Businesses, Industries, Professions
[ ] Health care settings*
[ X ] Other, specify Universities

**b.** ***Identify who will recruit potential participants and describe the recruitment process.*** *Provide a copy of any materials to be used for recruitment (e.g. posters(s), flyers, advertisement(s), letter(s), telephone and other verbal scripts in the appendices section.*

Prospective interviewees will be identified through preliminary research and with the guidance of our client; we will pursue experts in the field. A member of our group will contact prospective interviewees via telephone or e-mail to recruit and arrange meetings.

A template email and phone call are attached as Appendix A.

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

**6. Feedback to Participants**
**Briefly describe the plans for provision of feedback and attach a copy of the feedback letter to be used**.

Wherever possible, written feedback will be provided to study participants including a statement of appreciation, details about the purpose and predictions of the study and contact information for the researchers. A copy of an executive summary of the study outcomes will also be provided to participants.

**POTENTIAL BENEFITS FROM THE STUDY**

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

There are no known or anticipated direct benefits to the participants from their involvement in the project.

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

This study will provide the client and decision-makers at Dalhousie with information that will facilitate them participating in the COMFIT program. If the client and/or Dalhousie University decide to generate renewable energy as part of the COMFIT project they will be contributing to reducing greenhouse gas emissions in Nova Scotia. There are many tangible and intangible economic, environmental and social benefits to generating renewable energy that this research will contribute to. If Dalhousie participates in the COMFIT program there will be many associated educational benefits for future students and community members.

The proposed study is part of an Environmental Problem Solving course offered by Dalhousie University, which is founded on the principle 'the campus as a living laboratory'. By engaging students in large research projects, students are expected to feel empowered to foster sustainable developments at the University and in their communities. University courses of this type are relatively new, but have the potential to benefit society at large as we transition to a sustainable society.

## POTENTIAL RISKS TO PARTICIPANTS FROM THE STUDY

1. **For each procedure used in this study, provide a description of any known or anticipated risks/stressors to the participants. Consider physiological, psychological, emotional, social, economic, legal, etc. risks/stressors and burdens.**
   [ ] No known or anticipated risks Explain why no risks are anticipated:
   [ X ] Minimal risk * Description of risks:
   [ ] Greater than minimal risk** Description of risks:
   ** This is the level of risk associated with everyday life. ** This level of risk will require ethics review by appropriate Dalhousie Research Ethics Board*
   **2. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants in light of the risks/stresses identified in Question 1.**

## INFORMED CONSENT PROCESS

**1.** What process will be used to inform the potential participants about the study details and to obtain their consent for participation?
[ X ] Information letter with written consent form; provide a copy **See Appendix B**
[ ] Information letter with verbal consent; provide a copy
[ ] Information/cover letter; provide a copy
[ ] Other (specify) ______________________________________________

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

## ANONYMITY OF PARTICIPANTS AND CONFIDENTIALITY OF DATA

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

Participants will not be anonymous. We will obtain written consent from the interview participants for their names to be attributed to the information that we obtain in the interview.

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

Audio recording and paper notes will be kept in a secure location for the duration of the study.

3. **Indicate how long the data will be securely stored as well as the storage location over the duration of the study. Also indicate the method to be used for final disposition of the data.**

[ ] Paper Records
[ ] Confidential shredding after ______
[ ] Data will be retained until completion of specific course.
[ ] Audio/Video Recordings
[ ] Erasing of audio/video tapes after ______
[ ] Data will be retained until completion of specific course.
[ ] Electronic
[ ] Erasing of electronic data after ______
[ X ] Data will be retained until completion of specific course.
[ ] Other ________________________________________________________________

Data that could be useful for further study will be included in appendices of the final report. Audio recording and written notes will be destroyed at the completion of the course in April.

**Specify storage location:** Locked filing cabinet.

**Appendices: ATTACHMENTS** Please **check** below all appendices that are attached as part of your application package:
[ X ] **Recruitment Materials**: A copy of any poster(s), flyer(s), advertisement(s), letter(s), telephone or other verbal script(s) used to recruit/gain access to participants. **(Appendix A)**
[ X ] **Information Letter and Consent Form(s)**. Used in studies involving interaction with participants (e.g. interviews, testing, etc.) **(Appendix B)**
[ ] **Information/Cover Letter(s)**. Used in studies involving surveys or questionnaires.
[ X ] **Materials**: A copy of all survey(s), questionnaire(s), interview questions, interview themes/sample questions for open-ended interviews, focus group questions, or any standardized tests used to collect data. (**Appendix C)**

**SIGNATURES OF RESEARCHERS**

Signature of Student Investigator(s) Date

____________________________________________________

Signature of Student Investigator(s) Date

____________________________________________________

Signature of Student Investigator(s) Date

____________________________________________________

Signature of Student Investigator(s) Date

____________________________________________________

Signature of Student Investigator(s) Date

____________________________________________________

Signature of Student Investigator(s) Date

______________________________________________________

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

______________________________________________________

Signature Date

______________________________________________________

Signature Date

**Appendix A Recruitment Materials**

**Email:**

Hello,
My name is (insert name) and I am an undergrad student working under the supervisions of Rochelle Owen in the College of Sustainability and Environmental Sciences Programs at Dalhousie University. I am contacting you because of your expertise relating to our study on the feasibility of Dalhousie participating in the Nova Scotia Community Feed-In Tariff (COMFIT) program.

The reason that I am contacting you is that we are conducting a study to determine how Dalhousie University could meaningfully participate in the COMFIT program. We are trying to answer question relating to financing, partnerships, and key processes and people.

Participation in this study involves meeting with student researchers and answering questions relating to your field of knowledge. With your permission, the interview will be tape-recorded to facilitate collection of information, and later transcribed for analysis. Participation will take about 1-1.5 hours.

If you are interested in participating, please contact me at ***renewableenergy3502@gmail.com*** and list your top three choices for when you would like to be interviewed. I will then call you to confirm a time and arrange a location.

Sincerely,

**Matt Andrews,**

**Kathleen Heymans,**

**Lee Hughes,**

**Quin Mackenzie,**

**Meaghan Maunde,**

**Kaleigh McGregor-Bales**

**Telephone:**
P = Potential Participant; I = Interviewer

I - May I please speak to [name of potential participant]?

P - Hello, [name of potential participant] speaking. How may I help you?

I - My name is [insert researcher name] and I am part of a team of undergraduate students in Environmental Science at Dalhousie University. I am currently conducting research under the supervision of Rochelle Owen on the feasibility of Dalhousie participating in the COMFIT program. As part of my research, I am conducting interviews with stakeholders and professionals such as planners and administrators to discover their perspectives on the feasibility of Dalhousie participating in the COMFIT program.

As you have experience and knowledge that could contribute to our understanding, I would like to speak with you about your perspectives on _____. Is this a convenient time to give you further information about the interviews?

P - No, could you call back later (agree on a more convenient time to call person back).
OR
P - Yes, could you provide me with some more information regarding the interviews you will be conducting?

I - Background Information:

- I will be undertaking interviews starting in [insert date].
- The interview would last about one hour and a half, and would be arranged for a time convenient to your schedule.
- Involvement in this interview is entirely voluntary and there are no known or anticipated risks to participation in this study.
- The questions are quite general (for example, insert sample question).
- You may decline to answer any of the interview questions you do not wish to answer and may terminate the interview at any time.
- With your permission, the interview will be tape-recorded to facilitate collection of information, and later transcribed for analysis.
- If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please feel free to contact name at (902) XXX-XXXX.
- After all of the data have been analyzed, you will receive an executive summary of the research results.

With your permission, I would like to email you an information letter which has all of these details along with contact names and numbers on it to help assist you in making a decision about your participation in this study.

P - No thank you.
OR
P - Sure (get contact information from potential participant i.e., mailing address/fax number).

I - Thank you very much for your time. May I call you in 2 or 3 days to see if you are interested in being interviewed? Once again, if you have any questions or concerns please do not hesitate to contact me at 902) XXX-XXXX.

P - Good-bye.

I - Good-bye.

**Appendix B Information Letter and Consent Form**

Feasibility of Dalhousie participating in COMFIT

The purpose of this research is to determine the ways that Dalhousie University could meaningfully participate in the Nova Scotia Community Feed-In Tariff (COMFIT) program.

- Involvement in this interview is entirely voluntary and there are no known or anticipated risks to participation in this study.
- You may decline to answer any of the interview questions you do not wish to answer and may terminate the interview at any time.
- With your permission, the interview will be tape-recorded to facilitate collection of information, and later transcribed for analysis.
- After all of the data have been analyzed, you will receive an executive summary of the research results.

or
**my answers are not attributed to my name**.

**Audio recording:**

I ____________________________ consent to having the interview recorded for further analysis by the group.

**Signature: ____________________________ Date: ____________________________**

**Appendix C Interview Themes/Sample Questions**

**Introduction:**

**The purpose of this research is to determine ways that Dalhousie University could meaningfully participate in the Nova Scotia Community Feed-In Tariff (COMFIT) program. In order to answer this question our research will attempt to identify key attributes that Dalhousie could offer to a COMFIT project. We will attempt to identify the key people in the University community who are necessary to the success of the project. We will identify potential partnerships that would allow Dalhousie to participate in COMFIT. Lastly, we will identify the benefits to Dalhousie of participating in the COMFIT program.**

The COMFIT program is relatively new and there is very little literature or documentation related to Universities participating in the program. Further there is very little documented on the successes and challenges associated with generating renewable electricity through the program. For this reason we have decided to conduct interviews to answer the research questions.

**1) Partnership**
Please describe your COMFIT project.
What stage is your project in?
What needs does/did your organization need to succeed in the COMFIT project?
Are there ways that your project needs/needed support to be realised?
How did you attract shareholders for your Community Economic Development Investment Fund (CEDIF)?
What were challenges you faced during the COMFIT process?

**2) Finance**
What kind of budget does Dalhousie have for renewable energy projects?

Do you think there would be interest among university financial decision makers to invest or donate funds towards a wind turbine feeding energy into the grid through the COMFIT program?

Has Dalhousie ever partaken in a CEDIF before?

Do you see Dalhousie getting involved in a project like this as a possibility in the future?

**3) Administration/Logistics**
Can you please help us understand the steps that Dalhousie, as a university must take to participate in COMFIT?
Where is the bottleneck in the application process? What is causing the back-log?
Where is there available space on the grid?
Are there common problems that come up in COMFIT applications?
Is solar energy likely to be added into COMFIT?
What criteria determines land suitability?
Once the application is completed and approved what is the process and timeline?

**4) Technology**
We are the consideration for small vs. big turbines?
What criteria determines land suitability?

Can you provide financial data to us?
Once the application is completed and approved what is the process and timeline?
What technical expertise is necessary?
What technical expertise does Dal have?
What technical expertise does Dal need?

**5) COMFIT Applicants**
What challenges did you face in your project?
What criteria determines land suitability?