Wind energy in Nova Scotia's electrical power generation sector: The development of an effective wind energy regime

"If the winds of change blow, some build walls, others build windmills."
-Chinese Proverb

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Executive Summary

Three major goals of renewable energy policy include security of supply, environmental protection, and economic development and stability. One way in which our society can work towards achieving these goals is through the addition of wind and/or other renewable energy sources to the electrical grid. This can be accomplished through the use of a 'portfolio of tools' that includes, but is not limited to, the following tools: regulatory, fiscal, research and development, and public education. Such tools can enable the electricity sector to achieve certain goals that will encourage greater penetration[1] of wind and/or other renewable sources. Such 'electrical sector goals' include grid access, the right to sell electricity, a competitive/fair price for a unit of electricity, increased affordability of development, greater public support, and skill development and employment.

Currently, Nova Scotia has set forth many goals and targets to encourage renewable energy development, and thus, achieve the renewable energy policy goals. With the enactment of the *Environmental Goals and Sustainable Prosperity Act* (2007), Nova Scotia set forth a goal to reduce its greenhouse gas (GHG) emissions by at least 10 percent of 1990 levels by the year 2020 (Hatch, 2008). This goal was expanded upon in the Energy Strategy (2009), to include an 80 percent reduction in GHG and air-pollutant emissions. Furthermore, the 2007 Renewable Energy Standards (RES) under the Nova Scotia *Electricity Act* require that five percent of electricity generation from all suppliers in 2010 to be produced from post-2001 renewable energy sources, with this value increasing to 10 percent by 2013 (Hatch, 2008). The Energy Strategy (2009) expanded on the 2007 RES through setting a provincial goal of 25 percent electricity produced from renewable sources by 2020, with the potential to develop as much as 40 percent, using a combination of wind, biomass, tidal, and imported energy (NSDE, 2009). However, many barriers exist preventing greater penetration of wind and other renewable technologies in the province in order to meet these goals and targets.

This study presents these barriers as defined through an extensive literature review and consultation with 17 stakeholders within the electrical power generation sector between January 18, 2009 and March 4, 2009. Information was analyzed using an *a posteriori* coding scheme. Accordingly, the emerging themes (barriers and solutions) identified within the literature review and interview process were emphasized within the final thesis document.

Barriers identified broadly include policy, social perception, technical constraints, cost, transparency, market structure, government support, research and development, intermittency, and turbine impacts. Recommendations capable of overcoming or mitigating the barriers to achieve the desired 'electrical sector goals' were presented with consideration for the 'portfolio of tools' available. Such recommendations broadly focus upon regulatory tools, fiscal tools, market structure, utility restructuring, research and development tools, public education tools, and intermittency and coincidence.

[1] For the purpose of this study, penetration of wind and other renewable energy technologies is defined as the addition of greater wind and/or other renewable capacity to the electrical grid in Nova Scotia.

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Chapter 1

Introduction

Research Question

How can the current barriers inhibiting wind development in Nova Scotia be overcome in light of creating an increasingly effective[2] wind energy regime?

Overview

Three major goals of renewable energy policy include security of supply, environmental protection, and economic development and stability. One way in which society can work towards achieving these goals is through the addition of wind and/or other renewable energy sources to the electrical grid. This can be accomplished through the use of a number of tools including, but not limited to, regulatory tools (a renewable portfolio standard (RPS) and Net Metering), fiscal tools (a feed-in-tariff (FIT), subsidies, green power programs), public education tools (education and awareness campaigns), and research and development tools (investment programs for the development of renewable technologies), collectively referred to as a 'portfolio of tools' (Lipp, 2008; McCoombs, 2005; Tu, 2005). In Nova Scotia, a combination of these tools aimed at encouraging the development of wind energy is in effect. These tools include a mandatory RPS, subsidies for the development of green initiatives, and Net Metering.

Such tools can enable the electricity sector to achieve certain goals that will encourage the penetration[3] of wind and other renewable energy sources, thus, allowing Nova Scotia to achieve security of supply, environmental protection, and economic development and stability. Such 'electrical sector goals' include grid access, the right to sell electricity, a competitive/fair

[2] For the purposes of this project, effectiveness will be defined as the ability of a renewable wind energy regime to achieve the desired renewable energy policy and electrical sector goals.

[3] For the purpose of this study, penetration of wind and other renewable energy technologies is defined as the addition of greater wind and/or other renewable capacity to the electrical grid in Nova Scotia.

price for a unit of electricity, increased affordability of development, greater public support, and skill development and employment.

Currently, Nova Scotia has set forth many goals and targets to encourage renewable energy development. With the enactment of the *Environmental Goals and Sustainable Prosperity Act* (2007), Nova Scotia set forth a goal to reduce its greenhouse gas (GHG) emissions by at least 10 percent of 1990 levels by the year 2020 (Hatch, 2008). This goal was expanded upon in the Energy Strategy (2009), to include an 80 percent reduction in GHG and air-pollutant emissions by 2050. Furthermore, the 2007 Renewable Energy Standards (RES) under the Nova Scotia *Electricity Act* requires that five percent of electrical generation from all suppliers in 2010 to be produced from post-2001 renewable energy sources, with this value increasing to 10 percent by 2013 (Hatch, 2008). The Energy Strategy (2009) expanded on the 2007 RES through setting a provincial goal of 25 percent electricity produced from renewable sources by 2020, with the potential to develop as much as 40 percent, using a combination of wind, biomass, tidal, and imported energy (NSDE, 2009). It is clear that Nova Scotia has made a commitment to greening the province's electricity grid. However, questions remain regarding the adequacy of these goals and targets, and how effectively they are being managed and implemented.

It is acknowledged that wind energy is associated with drawbacks that include intermittency in output (Gipe, 2004; NSDE, 2007; Hatch, 2008), noise and visual impacts (Jobert *et al.*, 2007; Wolsink, 2007; Ackermann *et al.*, 2000), environmental impacts associated with construction, operation, and infrastructure (Ladenburg, 2008; Wolsink, 2007; Ackermann *et al.*, 2000), and costly infrastructure development and upgrades (Hatch, 2008). However, it is believed that these drawbacks can be mitigated through greater focus on diversification of energy sources, the development of sustainable back-up energy sources to support the grid during times of intermittency, adequate levels of public consultation, realistic environmental assessment processes that accommodate a diverse range of interests, proper siting of wind turbines, and demand side management strategies, including load reduction, peak shifting, and peak clipping, to take advantage of the wind when it is available (Wolsink, 2007; Ackermann *et al*., 2000; Refocus, 2002; NRCan, 1994).

It has also been suggested that the development and upgrading of infrastructure to accommodate greater wind energy in Nova Scotia will cost C$100s of millions (Hatch, 2008). However, these costs may be offset by the rising price of fossil fuels and the reduction in carbon emissions that can be realized through the development of wind energy (Hatch, 2008). The 2013 RES target in Nova Scotia of 10 percent of electricity produced from post-2001 renewable sources, an estimated 311 megawatts (MW) of wind electricity, is attainable given the current infrastructure in place (Hatch, 2008). However, detailed impact assessments are required to fully understand the cost and technical implications associated with upgrading current grid infrastructure to withstand operational demands beyond 2013 (Hatch, 2008).

In light of the drawbacks previously addressed, it is important to recognize that many benefits can be realized from the development of an effective wind energy regime. Benefits include economic gains in small communities, including job creation and the formation of a spin-off industry, energy security, environmental protection through decreased emissions of GHGs, nitrogen oxides (NO_x), and sulphur oxides (SO_x), and decreased externalities, including health care costs associated with respiratory problems (Tu, 2005; Hatch, 2008; Hughes, 2007). Distributed wind can be utilized to take advantage of the modular nature of wind and bring the scale of generation down to the local community level (Gipe, 2004). It is noted that wind turbines can be dispersed across the province to fulfill energy needs where required, thus, reducing the energy lost in transmission and increasing the resiliency of the system (Gipe, 2004). However, turbines developed at the community level must be large enough to yield economic gain (>1-2 MW) for the individual or co-operative involved, as smaller wind turbines can prove material intense, provide less CO_2 offset, and will not last as long (Respondent fourteen).

Research Problem

This qualitative study analyzed the barriers currently preventing greater wind energy penetration in Nova Scotia and presented recommendations capable of overcoming or mitigating the barriers in light of achieving the 'electrical sector goals'. By realizing the 'electrical sector goals', the province can attract more wind and other renewable technologies to the grid, and thus, attain greater energy security, environmental protection, and economic development and stability. Current renewable energy policies introduced in Nova Scotia have effectively triggered an interest in learning at all stages of project and policy development (Lipp, 2007). However, barriers exist that limit the ability of the electrical generation sector to achieve a number of these 'electrical sector goals', thus, inhibiting the creation of an effective wind energy regime.

This study focused upon the barriers inhibiting greater penetration of wind technologies within the electrical power generation sector in Nova Scotia and the solutions capable of overcoming or mitigating these barriers, as identified through an extensive literature review and interview process. Recommendations were then proposed in light of encouraging greater development of wind technologies in Nova Scotia. These recommendations focused upon easing the transition from conventional resource use to renewable resource use for consumers, private businesses, and the government. Although not of central focus to this project, recommendations acknowledge the importance of efficiency improvements and scaling back energy use prior to implementing an energy transition.

The catalytic validity[4] of this study stems from the use of the recommendations herein to provide a sound basis for the continuation of scholarly inquiry with respect to a transition from conventional fuel sources to renewable energy sources including, wind, solar, tidal, geothermal, hydrogen, hydropower, and biofuels within Nova Scotia, Canada, and beyond. This paper will also add to the current literature surrounding the creation of effective wind and other renewable energy regimes, thus, promoting awareness and advocacy.

Why Encourage Renewables?

"He who owns the oil will own the world."
- Henri Berenger, French industrialist and Senator, 1919

The majority of Nova Scotia's current energy supplies are fragile and vulnerable to upset in the global socio-economic and energy systems. While supplies of available light sweet crude are becoming increasingly scarce, global demand for energy is growing rapidly and prices are subject to heightened volatility (Tertzakian, 2006). As a result of supply uncertainty and the volatile prices associated with crude oil, prices for other products are impacted: including coal, natural gas, and uranium on the primary side and secondary products like gasoline and electricity (Hughes, 2008). This combination of factors leads to adverse impacts on the global geopolitical climate and the economy (Tertzakian, 2006). Developing energy sources that are largely independent of current market dynamics, resource availability constraints, and political tensions can alleviate some of the political and economic uncertainty associated with energy dependence (Tertzakian, 2006). As such, the development of renewable wind technologies is considered to be a viable alternative to conventional energy sources.

Security of supply plays a pivotal role as a goal of renewable energy policy in Nova Scotia. The province is currently producing 88% of its electricity from conventional, fossil fuel

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[4] Catalytic validity is the degree to which research motivates those who are exposed to it to further their understanding of the world and the way it is shaped in manner that enables them to transform it (Denzin, 1998).

sources (NSDE, 2007), relying heavily upon imported sources of coal from Columbia, Venezuela, and the United States (Hughes, 2008). This leaves Nova Scotia vulnerable to the volatility of the global political scene and market. In contrast, greater development of renewable energy would enable Nova Scotia to independently produce a secure and sustainable energy supply, eliminating the current level of dependence upon volatile oil producing regions and governments.

Environmental protection is also a key goal of renewable energy policy. The International Panel on Climate Change (IPCC) has called for a 60-90 percent reduction of global carbon dioxide (CO_2) emissions from the current level over the next 50 years to maintain the current concentration of CO_2 in the atmosphere (IPCC, 2007). Both Nova Scotia and Canada are large contributors to the GHG levels in the atmosphere (Hatch, 2008). More specifically, Nova Scotia's electrical grid produces 46 percent of the provinces GHG emissions, in addition to emissions of SO_x, NO_x, particulate matter (PM), volatile organic compounds (VOCs), and mercury (Hg) (Hatch, 2008; Lipp, 2008; NSDEnv, 2009a). It has been suggested that the damage avoided per kilowatt-hour (kWh) of electricity generated from wind include: 1,000 grams (g) of CO_2, 6.5g of sulphur dioxide (SO_2), and 4.5g of NO_x (AWPC, 2005). This is likely attractive to Canadians, given that the IPCC indicates, "climate change in polar regions is expected to be among the largest and most rapid of any region on Earth, and will cause major physical, ecological, sociological and economic impacts, especially in the Arctic" (Boyd, 2003). Accordingly, Canadians may experience disproportionate consequences from climate change, as GHG concentrations in the atmosphere continue to rise. In light of protecting natural assets for generations to come and meeting commitments to the global and national community, more sustainable ways of life must be adopted. In particular, more sustainable ways to generate the energy required to maintain the lifestyles Nova Scotians currently enjoy.

Another key goal of renewable energy policy is economic stability and development. Society and everything consumed is in some way dependant, either directly or indirectly, upon oil or other petroleum derivatives (Tertzakian, 2006). Removing our dependence upon volatile energy prices will result in greater price stability. Renewable energy development can also stimulate community level job creation and spin-off industry. Moreover, the economic viability of coal as an electricity source in Nova Scotia may be reduced as a result of the rising cost of coal required to power the thermal generating plants in the province and the sulphur dioxide emissions cap under the amended Air Quality Regulations coming into effect in 2010 (Lipp, 2006; NSDE, 2007). Given Nova Scotia's dependence upon coal, estimated to account for 78 percent of electricity production in 2001, alternative energy sources need to be sought (NSDE, 2007).

Nova Scotia has the potential to decrease its reliance on conventional fuels through greater exploration of an abundant natural resource at its doorstep - wind energy. Wind energy is secure, associated with low-carbon outputs, and not linked to the market volatility characterizing conventional fuels (Hughes, 2008). Currently, Nova Scotia is leading Atlantic Canada in the production of wind electricity for domestic consumption, with 41 turbines operating across the province, an installed capacity of 61MW, and 246MW of project capacity awaiting development to meet the 2010 RES target (NSDE, 2008a; NSPI, 2005a). As coal, natural gas, and petroleum products become increasingly less desirable energy sources, electricity will become more attractive to Nova Scotian consumers, given the infrastructure already in place (Hughes, 2008).

Thus, development of wind-generated electricity seems to be a natural step in the progression to a more sustainable electrical power generation sector within Nova Scotia.

Should a widespread transition to renewable energy sources occur, society would likely move through a number of stages to reach a position where it is no longer dependent upon volatile energy sources. According to Tertzakian (2006), the cycle of energy evolution involves four stages:

- Growth and dependency upon an energy source
- A pressure buildup
- A breakpoint
- And finally, rebalancing within society in which growth of dependency on a new energy source begins (p.6).

In the growth and dependency phase, new energy forms are discovered and integrated into many technologies and uses that enhance the quality of life within society (Tertzakian, 2006). Growth is driven by increasing economies of scale and the rapidly rising utility related to the consumption of the exploited energy source (Tertzakian, 2006). In the next phase, scarcity of resources in addition to geopolitical, social, and economic forces associated with broad social use of a resource combine to exert increasing pressure on the usage of the energy source (Tertzakian, 2006). A breakpoint phase is reached when the pressure becomes insurmountable and the energy source is no longer viable (Tertzakian, 2006). At this breakpoint, difficult choices are made as consumers face declining utility from all sectors affected by energy consumption, including environmental, social, and governmental (Tertzakian, 2006). Finally, during the rebalancing phase there are four steps that are evident as new energy sources are developed and generalized (Tertzakian, 2006). Tertzakian (2006) has identified these steps as: "complaining and paying up, conserving and being efficient, adopting alternative energy sources, and finally making societal, business and lifestyle changes" (p.183). Effective renewable polices can play an important role in facilitating movement through each of these stages, enabling a faster, more cost effective transition between energy sources.

The Agenda

Chapter 2 includes a literature review that provides an overview of the 'portfolio of tools' currently utilized in Nova Scotia and those available to enable the province to meet the 'electrical sector goals'. This chapter also offers differing viewpoints on the goals, barriers, and mitigative solutions relevant to wind and other renewable energy development in Nova Scotia and other jurisdictions, and provides the steps for project development in light of the information collected. Chapter 3 is dedicated to examining the plan of inquiry, providing a detailed description of the methods that were followed during collection and analysis of information. Chapter 4 provides an overview of barriers and solutions as presented by interview respondents, followed by the researchers analysis of the accuracy of each barrier. Chapter 5 presents recommendations intended to overcome or mitigate a select number of barriers addressed in Chapter 4. Chapter 6 will provide a summary of the work completed and speculate on the future areas of study relevant to wind and other renewable technology development in Nova Scotia.

Literature Review

Introduction

This chapter outlines the current legislation and strategies aimed at further developing the renewable electrical power generation sector in Nova Scotia and the current processes through which electricity is provided to Nova Scotians. Four broad categories of legal tools available in Nova Scotia are discussed: fiscal, regulatory, public education, and research and development. The chapter also examines the two most successful and widely used legal tools in the development of renewable wind energy regimes, the renewable portfolio standard (RPS) and the feed-in-tariff (FIT). Finally, literature regarding the barriers preventing increased penetration of renewable wind energy and potential mitigative solutions required to overcome these barriers are discussed. To conclude, future directions for research in light of the findings in the literature review are addressed.

Wind Power Policies in Nova Scotia

Nova Scotia has taken many steps to attract renewable energy development within the province. The Nova Scotia Energy Strategy (2002) set voluntary short-term capacity goals for the development of 50 megawatts (MW) of renewable energy in the province by 2010 (Tu, 2005). In this energy strategy, a commitment was made for the establishment of a mandatory RPS after three years (OECD/IEA, 2008). In 2004, under the Nova Scotia Department of Energy *Electricity Act* (2004), the province was given the legislative power to enact a mandatory RPS (Bradely, 2005). Also included within this Act was the requirement that Nova Scotia Power Incorporated (NSPI) establish a tariff or toll for carrying power from other generators within their grid system, encouraging private developers to sell directly to their clients (Lipp *et al.*, 2006). In addition, the six municipality-owned utilities in the province were permitted to purchase power from generators other than NSPI, opening approximately 1.6 percent of the market to wholesale competition (Lipp *et al*., 2006; Hughes, 2007).

The Nova Scotia Department of Energy "Smarter Choices for Cleaner Energy: The Green Energy Framework" (2005), aimed to reduce greenhouse gas (GHG) emissions in Nova Scotia by 1.5 million tonnes per year, in part through the development of 280MW of wind power (Lipp *et al*., 2006). Furthermore, the Nova Scotia enacted *Environmental Goals and Sustainable Prosperity Act* (2007) set forth provincial goals to reduce GHG emissions by no less than 10 percent of 1990 levels by 2020; a reduction equivalent to 5 megatonnes (Hatch, 2008; NSDEnv, 2009a). In January 2009, the province released the Climate Change Action Plan, in which regulatory caps for GHG and air-pollutant emissions were proposed for NSPI, who now produce 46 percent of the provinces GHG emissions (NSDEnv, 2009a). Caps take effect in 2010, 2015, and 2020 (NSDEnv, 2009a). These regulations will require NSPI to cap GHG and air-pollutant emissions at 9.7 million tonnes in 2010, 8.8 million tonnes in 2015, and 7.5 million tonnes in 2020 (NSDEnv, 2009b). This will yield a total reduction of 2.5 million tons below 2007 emission levels at 10 million tons produced (NSDEnv, 2009b). The long-term goal after 2020 will be an 80 percent reduction in GHG and air-pollutant emissions by 2050 (NSDEnv, 2009a). Thus, encouraging greater use of technologies associated with low GHG and air-pollutant emissions, including wind and other renewable resources.

On February 1, 2007, the Nova Scotia Renewable Energy Standards (RES) under the *Electricity Act* came into force (Lipp *et al*., 2006; Hatch 2008; NSDE, 2008b). These involuntary standards required that five percent of electrical generation from all suppliers in 2010 to be produced from post-2001 renewable energy sources, with this value increasing to 10 percent by 2013 (Lipp *et al*., 2006; Hatch 2008). The Energy Strategy (2009) expanded on the 2007 RES through setting a provincial goal of 25 percent electricity produced from renewable sources by 2020, with the potential to develop as much as 40 percent, using a combination of wind, biomass, tidal, and imported energy (NSDE, 2009). Furthermore, the Energy Strategy (2009) pledged to set a new interim renewable energy requirement for 2016, using results of technical studies and consultations (NSDE, 2009). The Energy Strategy (2009) also improved the Net Metering program, through increasing the project size limit from 10kW to 1MW, expanding the period for calculating net use from one to three years, and permitting NSPI customers to meter multiple accounts within a defined distribution zone (NSDE, 2009).

Electricity Distribution in Nova Scotia

The main organizations involved in Nova Scotia's electrical power generation sector include the Nova Scotia Government's Department of Energy, the Utility and Review Board (UARB), NSPI, the six municipal utilities, and Independent Power Producers (IPP) (Hatch, 2008). NSPI is a vertically integrated monopoly in Nova Scotia, owning and/or operating 97 percent of generation, 99 percent of transmission and 95 percent distribution in the province (Lipp *et al.,* 2006, Hatch, 2008; Tu, 2005). Under the *Public Utilities Act*, the UARB is the provincial regulator of the electrical power generation sector tasked with overseeing the activities of NSPI (Tu, 2005). To respond to increasing energy pressures, the provincial government reformed electricity policy in 2002 (Tu, 2005). This reform resulted in Integrated Electricity Planning (IEP), which requires NSPI to submit annual 10-year supply and demand forecasts for the province to determine how much extra power will be required in the coming year (Tu, 2005). To contract electrical power, a Request for Proposal (RFP) is presented to the private electricity sector to attract projects that will enable NSPI to meet supply demands in the coming year. Successful bids from private generators, which are often selected based upon 'lowest cost', will be granted a long-term power contract with NSPI that guarantees a fixed rate for a specified amount of power (Tu, 2005).

Since the *Electricity Act* came into effect on February 1, 2007, 1.6 percent of the market in Nova Scotia has been opened for wholesale competition (UARB, 2008a; Hughes, 2007). This created two electrical markets in Nova Scotia: one in which the majority of consumers receive and purchase electricity and another optional competitive market available for the six municipal utilities who purchase energy on a wholesale basis and are permitted to purchase electricity from retailers other than NSPI (UARB, 2008a).

The wholesale, competitive market is supported by the Open Access Transmission Tariff (OATT), designed to provide non-discriminatory access to NSPIs transmission system and recover the cost of provision of transmission and ancillary services provided by NSPI through a regulated tariff (UARB, 2008a). The OATT was modeled after the United States Federal Energy Regulatory Commission (FERC) 88 tariff, and allows IPPs to import and export power and wholesale customers to seek supply from generating facilities other than NSPI (BCG, 2008). The General Interconnection Procedures (GIT), an appendix to the OATT, is applicable to generating facilities desiring access to NSPI's transmission system (UARB, 2008b). The GIT includes procedures involved with administering generation interconnection requests, including application content, costs and fees, the order and process for completing the system studies and engineering, procurement, and construction processes, and standard interconnection and operating agreements (UARB, 2008b). Developers who have brought forth successful bids in response to an RPF and intend to utilize NSPIs transmission system, will be placed in a priority queue ('line-up') established by the GIT that protects the chronological order in which projects produced a valid application for interconnection (UARB, 2008b; Jacques Whitford, 2008). As of

September 2008, NSPI had 26 projects in the queue, with seven of these developers able to provide 246MW to meet the provinces 2010 RES requirement (UARB, 2008b; NSPI, 2005a).

Portfolio of Tools

The portfolio of tools available to assist Nova Scotia in the development of an economically viable, environmental sound, and socially attractive electrical power generation sector include: fiscal, regulatory, public education, and research and development. These tools influence both the rate of and the potential for wind energy development through compensating for some of the barriers faced by wind developers (Tu, 2005). Currently, the main driver in the development of wind energy in Nova Scotia is the RPS that is achieved using a competitive procurement process, the RFP.

Fiscal Tools

Fiscal tools can be price or tax-based and are utilized to reduce the capital cost of initiating new developments and increase the price paid to producers per unit of electricity generated, thus, making investment within the renewable electricity market more attractive (Tu, 2005; Lipp, 2008). Pricing fiscal tools include FIT, capital grants, tradable green power credits, and green power programs (Lipp, 2008). Tax-based fiscal tools include investment/property tax credits, accelerated tax depreciation, and investment taxes (Tu, 2005; Lipp, 2008).

FIT are statutory agreements that regulate the price that will be paid to renewable electricity producers for each unit of energy sold (Lipp, 2008). This approach requires that every kilowatt-hour (kWh) of electricity generated from renewable sources be priced at a level suitable for driving the development of green energy (EAC, 2007). Prices for a unit of electricity will vary based upon location, maturity of the technology, resource availability, and the scale of the project (Lipp, 2008). The provision of a guaranteed FIT for each unit of electricity provided to the grid reduces the investment risk through the provision of secure, predictable returns, and encourages a wider range of project sizes, geographic locations, and actors within the electrical power generation sector (Lipp, 2008; Toke *et al*., 2008). The cost above wholesale price is borne by the consumer, but evenly distributed across the marketplace (Lipp, 2008). This tool has been successfully implemented in Germany, Denmark, and Spain (Lipp *et al*., 2006; Toke *et al*., 2008; EAC, 2007). However, it should be noted that large utility companies, specifically within Germany, are strongly opposed to the use of such a tool, as they claim that competition within the marketplace is not preserved (Toke *et al*., 2008).

NSPI had previously offered a green power program that enabled consumers to voluntarily pay a premium of 4 cents per kWh above the residential rate for the purchase of power produced from renewable sources, providing consumers with a choice regarding the origin of their electricity (Hughes, 2002; Tu, 2005; Lipp, 2007). In 2006, this program was cancelled with assurances from NSPI that they would work with industry manufacturers to develop safe, reliable, low cost equipment to ensure that small-scale developers are able to enter the wind market and interconnect with the grid (Lipp *et al*., 2006).

Regulatory Tools

Regulatory tools are put in place by the government to support a technology through all stages of development and maturity (Lipp, 2008). These tools act to ensure that wind power can compete with conventional energy sources available on the market (Tu, 2005). Legal tools include the RPS, Net Metering, regulations surrounding green pricing, permitting, interconnection codes and standards, and emissions capping (Tu, 2005; Lipp, 2008). Currently, Nova Scotia utilizes a RPS, Net Metering, and is proposing NSPI emission caps under the Climate Change Action Plan (2009).

A RPS requires that electrical utilities generate (or purchase) enough electrical energy from renewable sources to meet a quota (Lipp, 2008). This guarantees a market for a certain amount of renewable energy. NSPI will issue an RFP to engage in contracts with independent renewable energy producers to ensure that it will meet the RPS quota (Lipp, 2008). The RPS approach preserves competition within the marketplace and is most effective when coupled with penalties for non-compliance (Lipp, 2008; Toke *et al*., 2008). As the cheapest form of renewable energy through which this quota can be achieved, wind energy has been the source of choice and the technology to see the most development using this approach (Lipp, 2008). The UK has utilized the RPS approach to develop their wind industry (Lipp, 2008; Toke *et al*., 2008). Additionally, large German electrical utilities have shown support for this tool and its ability to encourage competition within the marketplace, signaled by their development of an extensive portfolio of investments within the UK where this tool is implemented (Toke *et al*., 2008). However, the RPS approach is not always the lowest cost approach to development of renewable energy (Toke *et al*., 2008). The cost to develop a unit of renewable energy in the UK is higher than within Germany and Denmark, the two world leaders in wind energy development utilizing a FIT (Lipp, 2008). Moreover, the RPS approach often offers less predictable returns on investment and is subject to controversy surrounding what the optimum design rules should be (Toke *et al*., 2008).

Net Metering is offered by NSPI to allow customers to connect and feed into the grid from small-scale generating devices, while utilizing a bi-directional meter to monitor the electricity both consumed from and sold back into the grid (Lipp *et al.*, 2006). Net Metering encourages smaller-scale producers, no more than 1MW in size, to enter into the electricity market (Lipp, 2008).

Regulatory emissions caps have been proposed under the Climate Change Action Plan (2009). These regulations will require NSPI to cap GHG and air-pollutant emissions at 9.7

million tonnes in 2010, 8.8 million tonnes in 2015, and 7.5 million tonnes in 2020 (NSDEnv, 2009b). This will yield a total reduction of 2.5 million tons below 2007 emission levels at 10 million tons produced (NSDEnv, 2009b).

Public Education Tools

Public education tools aim to increase public awareness regarding the benefits of wind energy development and to guide and inform decision-making (Tu, 2005; McCoombs, 2005). These tools include educational campaigns, disclosure labels and training and support programs (Lipp, 2008). Public support of wind energy is a key to achieving greater penetration of wind technologies within Nova Scotia. Overall, public support for wind development is often strong, while the support for individual turbines within or near local communities can be subject to the Not-In-My-Backyard (NIMBY) syndrome (Wolsink, 2008). As such, greater levels of public education and awareness regarding the science behind advancing wind technologies and the costs and benefits associated with development may act to shift this level of support in favor of wind development (Wolsink, 2008).

Research and Development Tools

Research and development tools provide the funding required to further develop knowledge, stimulate technological innovation, and provide the training and skills required within a successful wind energy regime (Lipp, 2008). To demonstrate, in 2007 the provincial government provided a C$78,000 grant to researchers from the Université of Moncton and the Applied Geomatics Research Group at the Nova Scotia Community College for the development of an online wind atlas (NSDE, 2008b). This map comprehensively displays wind data, including wind speed, to the benefit of those planning to enter the market (NSDE, 2008b). Accordingly, investment in research and development is a key aspect of an effective wind regime.

The RPS vs. FIT Debate – Or is it?

Advocates of the RPS and FIT approaches have instigated a debate surrounding effective renewable energy development (Lipp, 2008). In the last decade, both the RPS and FIT have been used successfully to promote the development of renewable energy regimes (Lipp, 2008). Globally, forty jurisdictions (thirty-eight national governments) utilize the FIT, with Germany and Denmark having had the greatest success (Lipp, 2008; Toke *et al.*, 2008). Governments in over forty jurisdictions have implemented a RPS, eight being national governments, with the UK, Japan, and Australia representing notable examples (Lipp, 2008). In the FIT model, the focus is upon politically set prices and market based quotas (Lipp, 2008). The RPS model includes politically set quotas and prices set by the market (Lipp, 2008). Essentially, the disagreement lies in the focus of political interference. However, it has also been suggested that the RPS and FIT can function together to encourage renewable energy development, with the RPS functioning as the main overarching quota and the FIT functioning as the fixed price to achieve the overall target.

The RPS is favored by proponents of a free-market as it remains exempt from regulations surrounding the choice of technology and price when meeting politically set quotas (Lipp, 2008). Under an RPS, developers will have a choice regarding which tool they utilize to meet their target. For example, developers may use the FIT, RFP, or a combination of mechanisms to procure the generation required to meet their quota. However, in this system developers will likely choose the technology sufficient to achieve the quota at the lowest cost, decreasing the price of electricity available on the market (Lipp, 2008). The 'lowest cost' focus may result in the exclusion of diverse renewable energy sources and smaller-scale players from the market because of competition with larger electrical utilities that have experience and technologies enabling them to produce electrical power for less (Lipp. 2008; Gipe, 2004). Through utilizing the FIT to guarantee fixed prices when achieving the RPS quota, policy makers can ensure market stability and reduce the risk associated with investment in the renewable electricity market (Lipp, 2008). The FIT will ensure that all eligible projects will gain access to the grid and fixed pricing for power produced, enabling diversity of technology, project scale, and actors within the electrical power generation sector (Lipp, 2008).

Free-market proponents claim that the FIT places an excess burden on taxpayers and that guaranteed pricing removes competition in the market, and thus, generates electricity that is not generated and distributed at the lowest cost (Lipp, 2008; Toke *et al.*, 2008). However, the FIT recognizes and distinguishes between varying renewable technologies at different stages of development and factors in the generation costs when pricing energy (Lipp, 2008). As such, it is argued that competition is maintained, as developers purchase the best wind turbines at the lowest cost, driving the price of generation down (Lipp, 2008). Fixed pricing also encourages development in a range of different geographic areas, while a RPS in the absence of a FIT, can result in concentrated development along the coastline where the wind energy is the most powerful and thus, the cheapest to produce (Lipp, 2008). All too often, commodity-driven markets, as created by RPS, will result in developers taking short cuts and utilizing lower quality equipment at the expense of the environment (Gipe, 2004).

However, a RPS coupled with a RFP has been successful in driving wind energy development by larger scale players in the electrical power generation sector in Nova Scotia (Lipp, 2008). Should Nova Scotia wish to move towards smaller-scale distributed wind, incorporating the FIT approach within the current RFP model would provide smaller-scale developers the security and visibility required to enter the electricity market with confidence.

The choice of tool(s) in this situation would depend upon the goals of the electrical power generation sector in Nova Scotia: large scale and homogenous or distributed and diverse.

Road Blocks along the Path to Success

Previous scholars have identified several barriers preventing increased development of renewable energy sources, as well as solutions for overcoming these obstacles in light of developing an effective wind energy regime.

Tu (2005) identifies the barriers preventing greater penetration of wind technologies in Nova Scotia as unvalued social and environmental externalities associated with conventional fuels and wind energy, discriminatory regulations towards renewable energy development, and deficiencies in public information. These barriers collectively act as roadblocks, preventing greater development of wind energy and lead to increased development costs for those entering the renewable electrical power generation sector. Emphasized as critical to overcoming these barriers are policies that include strong, long-term governmental commitment directed towards attaining involuntary, clear, and measurable goals. Additionally, reform of regulations governing project development and investment in practical research and development is required.

According to McCoombs (2005), barriers preventing greater small-scale wind development in Nova Scotia include insufficient education to guide and inform decision-making, the lack of legislation to facilitate the development of wind projects, and the need for more incentives to lower investment risk and encourage wind developers to enter the market. Solutions suggested for overcoming the before-mentioned barriers include assigning a price based upon the true value of wind, having taken into account the economic, health, and environmental benefits incurred from development. Furthermore, opening the grid to distributed wind generation on a local scale was suggested to effectively increase stability, security, and encourage small-scale investment. Another solution involves the declaration of governmental support for renewable energy, through lobbying for its benefits, providing incentives, and greater funding for research and development projects. Finally, encouraging wind development in light of the barriers addressed will require the pursuit of increased public information campaigns to ensure consumers are informed in their decision-making.

Lipp (2008) insists that although goals and targets for Canadian provinces have been set with regards to increasing the use of renewable energy, the policy framework essential for success is absent. Current policies do not provide the support required by the renewable electricity sector and are often inconsistent, unclear, and conflict with policies in other domains. Wind development barriers include poor grid access, high project development cost, inefficient administrative processes, and a lack of understanding with regards to the requirements of a renewable electricity sector and the associated system modifications required for a transition. According to Lipp (2008), Canada is investing too little in renewable electricity research and providing insufficient means for developing greater diversification within the sector. The factors providing for the successful development of renewable energy in Europe included political commitment signaled by clear, measurable and often binding targets and consistent support policies. Additional critical factors included coalitions of support, mobilizing dialogue, enthusiasm of actors involved, including large-scale utilities, small-scale developers, the government, and consumers, and the choice of policy and design best suited to the area where it was applied. Lipp (2008) holds the position that steps towards the development of a successful renewable energy regime must involve an integrated response, taking into account a range of concerns including the economic barriers, technical barriers and societal acceptance. These steps must include the creation of clear, long-term goals and targets, prioritization of renewable energy goals, a holistic approach to energy planning, diversity in the market with regards to technology, scale, geographic location, and actors involved, support of innovation and human resource development, and finally, consideration for the true value of a unit of energy when pricing. Steps must also involve a comprehensive policy framework for Canada as a whole, coordinating both federal and provincial governmental action.

Gipe (2004) identifies several barriers preventing greater wind development, including the intermittent nature of wind, interconnection with the grid, a need for grid expansion to accommodate small-scale and remote users, and a lack of economic valuation for the environmental and social benefits inherent in wind power. Gipe (2004) notes that Germany successfully implemented FIT laws and created a world-class wind energy regime in light of attacks by some of the most powerful electric utilities in the world. When the German parliamentarian, Hermann Scheer, was asked how he overcame the resistive forces he replied, "We pushed" (p. 395). The importance of strong political and public commitment to move the development of wind technologies forward is critical. A solution to increase wind development was very clear to the Danish theologian, N.F.S. Grundtvig, who held that all public policy, and in general all human activity, should be life affirming. As such, the Danish developed wind energy on the foundation that they believed that it was the right thing to do. Just as Gipe (2004) showed, a solution to overcoming the obstacles preventing greater development of wind may lie in a value shift: choosing to make the transition to wind because it is the right thing to do.

Barriers and Solutions

Several themes arise when analyzing both the barriers preventing and solutions encouraging the development of wind and other renewable energy sources. Barriers identified within previous literature include: an insufficiency in policies that support wind development, a lack of binding, clear, and measurable goals and targets, an inadequacy of governmental prioritization of renewable energy policies, a lack of knowledge surrounding the regulatory and technical needs of the renewable electricity sector, the intermittency of wind, grid-interconnection, negative public perception surrounding the development of wind power, a lack of effective educational programs to guide and inform decision making, a need for greater incentives to encourage developers to enter the market, an inadequacy of investment in innovation and human capital, and a need for consideration of the true value of a unit of energy. Recommendations for overcoming these barriers as presented within previous literature include: creating a comprehensive policy framework with cooperation from federal and provincial levels of government to initiate strong, long-term, and transparent governmental commitment directed toward attaining binding, clear, and measurable goals. Additional solutions include reform of regulations governing project development, greater investment in practical research and human capital, fostering higher levels of public education surrounding renewable technologies, increased incentives for developers entering the market, assigning the true value to a unit of electricity given consideration for environmental and social externalities, encouraging economically viable distributed wind development, and finally, choosing wind because it is the right thing to do in light of sustainable development.

Project Contribution

It is clear that an extensive amount of literary inquiry has focused upon the development of effective wind energy regimes in many jurisdictions across the globe, including Nova Scotia. Although Nova Scotia has successfully developed 61MW of wind capacity, with 246MW of wind development pending to meet the 2010 RES targets (NSDE, 2008a), it tails behind world leaders in the implementation of effective wind energy regimes, including Germany and Denmark (Lipp, 2008; Toke *et al.*, 2008). This study will attempt to identify gaps within the current literature addressing the barriers to wind development in Nova Scotia and present recommendations associated with the ‘portfolio of tools’ aimed at achieving the ‘electrical sector goals’. Achieving the ‘electrical sector goals’ will enable Nova Scotia to increase energy security, environmental protection, and economic development and stability.

Chapter 3

Plan of Inquiry

Introduction

This chapter introduces the plan of inquiry, with reference to the sampling design, the tools utilized in the collection of information, the procedures followed, the analysis of information and emerging themes, and finally, the delimitations and limitations inherent within this study.

This qualitative study involved an extensive literature review and interview process aimed at the identification of barriers preventing greater development of wind energy in Nova Scotia and potential solutions capable of overcoming or mitigating these barriers. In light of this evaluation, gaps within current literature were filled and recommendations made for encouraging greater penetration of wind technologies within Nova Scotia's electrical power generation sector.

Sample

Documents considered within the literature review were selected purposively to fit within the scope of the study to ensure data appropriateness (Rudestam, *et al*., 2007). Interview participants were initially chosen using purposive sampling techniques to ensure that participating stakeholders are both engaged within the electrical power generation sector in Nova Scotia and/or knowledgeable about effective wind energy regimes. The initial list of interview participants was reviewed and approved by the project supervisor. Following contact with the initial participants, a snowball sampling technique was utilized to collect further contacts deemed knowledgeable by those actively involved within the industry. It should be noted the perspectives collected from stakeholders in the interview process were not intended to be representative of the views held by the industry as a whole. The interview process was simply intended to clarify, reinforce, and expand upon the researcher's knowledge of the topic area.

Tools

The tools utilized within this inductive study, exploratory in nature, included an extensive literature review and an interview process. The study combined retrospective elements (looking into the past), cross-sectional elements (examining the current situation), and prospective elements (looking into the future). The retrospective element of this study included a literature review to analyze previously published information. The cross-sectional element involved interviews to obtain a number of perspectives regarding the status quo within Nova Scotia's electrical power generation sector. Finally, the prospective element included the presentation of recommendations to achieve the 'electrical sector goals' and thus, encourage greater penetration of wind technologies within the electrical power generation sector in Nova Scotia.

The interviews were loosely structured and flexible, incorporating open-ended questions to ensure that the conversations flowed naturally towards the elements of discussion that the interview respondent deemed most significant. This ensured that results obtained included the most complete account of the interviewee's perspective and allowed for the identification of emerging themes. Interviews were conducted over the phone with the assistance of a tape recorder to capture the discussion. Rudestam (2007) recommends the use of tape recorders in open-ended interviews to ensure high fidelity of data recording.

Trustworthiness

The methods and results of a reliable study are reproducible by subsequent researchers interested in further analyzing the phenomena in question (Rudestam, *et al*., 2007). Validity is a measure of how well a study measures what it was intended to measure (Rudestam, *et al*., 2007). However, given the qualitative nature of this study and the use of a naturally subjective human observer, reliability and validity in a rationalistic sense cannot be assured (Rudestam, *et al*., 2007). Thus, trustworthiness has been argued to be a more appropriate term within the context of qualitative research (Denzin, 1998).

To ensure the trustworthiness of methods and results within the current study, the process of triangulation was utilized. Triangulation involves collecting information from a multitude of sources and crosschecking the findings to ensure that information is in agreement and to identify points of contention (Rudestam, *et al*., 2007). Information was collected from the literature and interview respondents and analyzed by the researcher to determine the level of agreement across the range of sources. This process ensured that the information gathered from various resources was in agreement. Areas characterized by conflicting evidence were analyzed more closely. Following the researcher's analysis, the findings were subject to a review by the project supervisor. Regular meetings with the project supervisor ensured that results, emerging themes, and project research and development moved forward in a productive and rational direction. According to Rudestam (2007), the review during regular meetings keep the researcher honest, a critical element of trustworthiness.

Data appropriateness also ensures trustworthiness, through the process of collecting information and sampling from sources chosen purposively to meet the needs and scope of the study (Rudestam, *et al*., 2007). An element of literature review occurred throughout the study to ensure that adequacy of the data is such that previously collected data is confirmed and understood (Rudestam, *et al*., 2007). The use of a tape recorder within the interview process ensured the high fidelity of data recording (Rudestam, *et al*., 2007).

Procedures

The preliminary literature review provided the foundation from which the electrical sector and renewable energy policy goals and the barriers preventing greater penetration of wind technologies in Nova Scotia were examined. With previous literature in mind, a preliminary list of goals and barriers was developed to fit within the scope of the current study. A portfolio of tools deemed adequate to overcome the initial barriers – regulatory, fiscal, public education, and research and development - was then proposed with reference to previous literature.

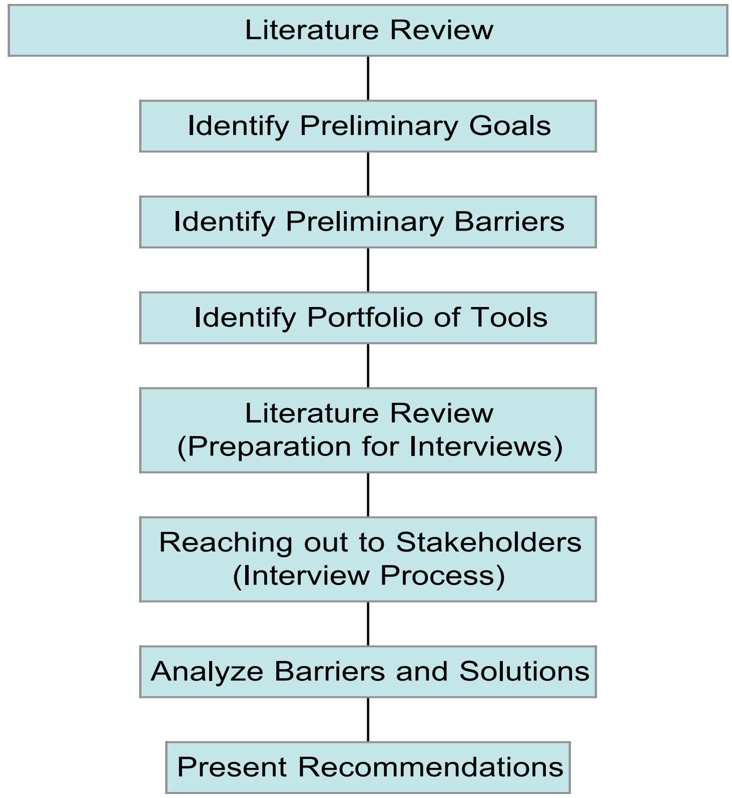

Figure 1. Summary of procedures followed en-route to the final thesis document.

Interviews were conducted between January 18, 2009 and March 4, 2009. The interview process was conducted to refine the list of preliminary barriers and identify mitigative solutions based upon the perspectives of 17 key stakeholders within the electrical power generation sector (See Appendix A). Interview guidelines were loosely structured and flexible, incorporating open-ended questions (Appendix B). Respondents were made aware of the nature of the study and the interview by e-mail. When e-mail proved to be an ineffective method of contacting stakeholders, phone calls were placed. Respondents were provided with the option to withhold confidential information during the discussion and to have elements of the discussion remain unrecorded. The interviews themselves were completed over the phone to ensure consistency, due to mobility restrictions, with discussions varying between 30 minutes to 2 hours. A follow-up e-mail was sent to the participant after each interview, thanking them for their contribution and providing further information about obtaining a copy of the final thesis document. The discussion was reflected within the final thesis document in a manner aligned with the respondents concerns for anonymity and confidentiality. As such, each interview respondent was assigned a representative number for use throughout the report; names and affiliations were excluded to protect each interview respondent's privacy. The interview process yielded a refined list of barriers and solutions reflecting the perspectives of the individual interview respondents. These barriers and solutions were used to fill gaps within the current literature surrounding wind energy development in Nova Scotia and guide the formation of recommendations for increasing the efficacy of the current wind energy regime.

Analysis

Information was analyzed using an *a posteriori* coding scheme. The literature review and interview process reflected the emerging themes and major issues within the electrical power generation sector in Nova Scotia, which are emphasized within the final thesis document. Emerging themes within the preliminary literature review were analyzed by the researcher and subject to review through discussion with the project supervisor and stakeholders. Following the interview process, a list of the barriers and solutions presented by each interview respondent was created in Microsoft Excel. This list was then color-coded based upon subject area to enable the researcher to visually group emerging themes and begin to create categories for the barriers and solutions. This stage of analysis was complete when all barriers and solutions suggested by respondents fell under a defined broad category, as presented in Chapter 4. Comparisons between the different stakeholder groups (Appendix A) were not drawn, as the sample size was inadequate and the information collected was not intended to be representative of the views held by each stakeholder group as a whole. The interviews were simply intended to clarify, reinforce, and expand upon the researcher's knowledge of the topic area.

The accuracy of each barrier was assessed through research yielding facts in support of or opposition to the barrier. In some cases, where time-constraints presented an issue, further avenues of further research to determine the accuracy of the barrier were defined. The researchers assessment of the barriers can be viewed in Chapter 4 under 'Researcher Recommendations'.

Delimitations

Several delimitations must be imposed in order to ensure the proposed study is able to adequately and appropriately address the research problem within the given time frame. This study focuses specifically upon the barriers and recommendations available in the electrical power generation sector in Nova Scotia, at the exclusion of other jurisdictions. The literature review focused upon policy documents currently in force. Given that renewable energy development became the focus of a limited number of jurisdictions during the past couple of decades, material dating from the 1990s to the present was the most relevant (Lipp, 2008). Due to time constraints, interviews were conducted with a limited number of individuals (17) (Appendix A). Focus was placed upon collecting the perspectives of individual stakeholders within the electrical power generation sector to further the researchers understanding of the topic area. Results are not considered representative of the industry as a whole. The choice to pursue open-ended interviews may also have proved to be delimitation, as discussion at times deviated from key points originally highlighted by the researcher. Alternatively, open-ended interviews were valuable in that they illuminated other emerging themes and issues.

Limitations

Several limitations must be addressed in the context of this study given the ability of these elements to impact the adequacy of information collected. Time was a major limitation throughout this project, hindering both the scope and depth of the research. The literature review process was limited to the material present in the public domain or provided by interview respondents. Interviews were limited by the willingness and availability of respondents to participate and engage in discussions to provide the requested information. Limitations also existed in light of restrictions placed upon the information that can be provided by individuals from private industry and the government (i.e. proprietary information) and the interview respondent's level of comfort with the disclosure of personal views and opinions. The interview process was also limited by researcher mobility restrictions. To maintain consistency, all interviews were completed over the phone. Technical difficulties resulted in the tape recorder functioning for only four out of seventeen interviews.

Chapter 4

Reaching out to Stakeholders

Introduction

This chapter provides an overview of the barriers preventing greater penetration of wind technologies within the electrical power generation sector and solutions capable of overcoming or mitigating the barriers, as identified by interview respondents. Respondents were asked (Appendix B):

- "What in your opinion and experience are the barriers preventing increased development of wind technologies within Nova Scotia?"
- "What changes would you recommend to overcome the barriers listed above?"

The barriers identified through consultation with interview respondents broadly include: policy, social perception, technical constraints, cost, transparency, market structure, government support, research and development, intermittency, and turbine impacts.

A synthesis of the specific barriers in each category as identified and discussed by the interview respondents will be expanded upon throughout this chapter. Following each barrier, there is a section entitled, 'Respondent Recommendations', where the solutions presented by interview respondents will be detailed, and a section entitled, 'Researcher Recommendations', where the researcher presents personal assessments of the accuracy of the barrier and/or defines further avenues of research that must be completed prior to determining the accuracy of the barrier. Essentially, 'Researcher Recommendations' provides a location for the researcher to present personal assessments regarding whether the barrier is indeed a barrier or only thought to be one.

Interview Overview

Policy

1. **Current policy mechanisms are not effective in encouraging renewable development**. The lack of coherent and focused government policy mechanisms to ensure Nova Scotia Power Incorporated (NSPI) will meet its renewable energy commitments was identified as a barrier by respondents three, six, seven, eight, twelve, and fourteen. The opinion of interviewees varied greatly with respect to the most effective policy mechanism(s) for use in Nova Scotia.
    a. **The RPS.** Respondents four and twelve indicated that the current Renewable Portfolio Standard (RPS) was an acceptable overall target or quota. Respondent fourteen disagreed, indicating that a RPS can lead to the semblance of progress towards renewable energy targets without concrete commitment on behalf of the government. Respondents one, nine, and fifteen indicated that the RPS is simply a goal that can be meet using a combination of mechanisms, including the request for proposal (RFP) process and/or a feed-in-tariff (FIT). Accordingly, respondents felt that the province needed to implement a more effective policy mechanism or combination of mechanisms to meet the RPS quota.
    b. **The RFP.** Many argued that the current RFP competitive procurement process inhibits greater penetration of wind technologies in Nova Scotia (Respondents one, two, three, four, eight, thirteen, fifteen, and sixteen). Reasoning included the high attrition rate of 30-50 percent as seen by developers bidding under the RFP (English, 2009), the risk associated with the lack of longer term project visibility in the absence of a fixed price, the inability for small to medium scale community generation (<2 megawatts (MW)) in Nova Scotia to compete financially with the

larger developers, and the administrative complexity associated with the bidding process and interconnection procedures (Respondents one, two, three, nine, fifteen). The high attrition rate was attributed, in part, to the inability of developers to supply power or realize profit at the price they won the RFP, due to the focus on 'lowest cost', coupled with the investors need for a greater return to account for the risks associated with low project visibility (Respondents two, thirteen, and fifteen).

Respondent Recommendations: Strong agreement existed in support of the FIT or Advanced Renewable Tariff (ART) (Respondents one, two, three four, eight, nine, ten, thirteen, fourteen, and sixteen). Respondents two and three indicated that the advantages of these models include price visibility and a higher price for a kilowatt-hour (kWh) at project onset when the capital investment is the greatest, thus, accelerating the ability of the developer to pay off debt and begin to profit and creating the potential for the provision of compensation packages to communities, reducing public opposition. Respondents one and eight indicate that a FIT would reduce the risk associated with engaging in wind development, as project proponents and financers will be better able to assess the return on investment. Respondent thirteen suggested that a FIT would encourage longer-term thinking and result in greater investment in the future security of energy supply. Respondent sixteen echoes support for the FIT or ART, indicating that it will result in economic benefits including job creation and spin-off industry development, local ownership and acceptance, diversity of supply, and greater energy security. Respondent three, fourteen, and fifteen note that using an FIT in the place of an RFP would minimize the complex and costly administrative system currently in place and provide Independent Power Producers (IPPs) a guaranteed right of connection. Respondent fourteen expands this recommendation to indicate that an FIT would not only provide a developer with the right to connect, but a right to sell electricity and yield a profit. In setting a fair price for the FIT, respondent one suggested that consultants be hired to assess the long-term cost of energy and ensure credit be given for environmental and social attributes. Respondent four indicated that an FIT set at 10 to 11 cents per kWh would allow wind developers to be more effective without needing to open the market to competition. This was echoed by respondent fifteen, who indicated that wind would be profitable at 11 to 13 cents per kWh. However, respondent eleven indicated that the FIT could be a less effective mechanism, as the benefit of a higher cost per kWh may transferred from the developer to the wind turbine suppliers, who realize that they can achieve greater profits in a market with little competition. Respondents nine and fifteen pointed to a renewable energy policy being considered in California, concentrating FIT attention on projects under 20MW to support smaller scale development that had originally been at a disadvantage in the competitive procurement process utilized to attain a RPS quota (KEMA, 2008).

Researcher Recommendations: A combination of policy mechanisms is deemed to be an appropriate solution to achieve greater wind development in Nova Scotia. The RPS is an appropriate mechanism to be utilized as an overall target. However, more effective means to meet this target are required in Nova Scotia as the RFP process is limiting to smaller scale players in the industry. A FIT for smaller scale development and/or improvement to the current Net-Metering program will be suggested. See Chapter 5 ‘Regulatory Tools’ ‘Recommendation 1’ and ‘Recommendation 2’.

2. **An absence of penalties for non-compliance with the RPS.** This barrier was addressed by respondents one, two, and three. Respondent one questioned the effectiveness of the RFP mechanism for achieving the RPS quota in the absence of penalties for developers

who default on Power Purchase Agreements (PPAs) with NSPI following success in the RFP process. Furthermore, should the government impose penalties on NSPI for failing to achieve the RPS quota, the financial burden could fall upon the ratepayers in Nova Scotia, providing no true incentive for NSPI compliance (Respondent three).

Researcher Recommendations: Firstly, respondent six indicated that NPSI had recently placed financial penalties on developers not delivering the electricity they were contracted for, thus, reducing the likelihood of default. Further research will be required to determine the value and adequacy of such penalties. Secondly, Lipp (2008) indicates that a RPS is more effective when coupled with a penalty for non-compliance. However, Hughes (2004) notes that the 2010 Renewable Energy Standard (RES) target for 5 percent new renewables is associated with no penalties should NSPI default on this commitment. With regards to the financial burden of the penalty falling on the ratepayers, should a penalty be instigated, the Utility and Review Board (UARB) will only allow an annual rate of return on the NSPI rate base[5] that is 'just and reasonable', generally equal to the rate of return received by other Canadian investors on investments of similar risk (UARB, 2008c). Thus, a likely alternative is that the actual cost of generation per unit of electricity would remain the same, and that the financial burden of the penalty would not be found a 'just and reasonable' expense for inclusion in the rate base. Accordingly, the financial burden would be placed on the shareholder return and executive compensation as opposed to the ratepayer.

3. **The current queue system under the Open Access Transmission Tariff (OATT).** This barrier was identified by respondents three, six, and seven. The OATT currently places IPPs responding to a RFP within the queue, in chronological order, to wait for access to

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[5] The rate base of a utility includes the physical assets used and useful in furnishing, rendering or supplying a particular service to the public (UARB, 2008c).

the grid (UARB, 2008b). NSPI is obligated to assess project marketability by completing power and infrastructure related studies, which determine the requirements and cost for each project (UARB, 2008b). These projects remain in the waiting list, or queue, irrespective of whether they are marketable, thus, backing up gird access and stalling the realization of marketable projects (Respondent seven). This situation results in an enhanced financial burden upon projects remaining in the queue that are ready for implementation and satisfy current market rules (Respondents six and seven).

Researcher Recommendations: To assess the validity of this barrier, research to assess the capital expenditure by NSPI on unfeasible projects and the financial burden placed upon subsequent projects in the queue is required.

4. **The current Net Metering program**. This was identified as a barrier by respondents seven, ten, thirteen, and sixteen. The Energy Strategy (2009) made the following changes to Net Metering in the province: an increase in project size limit from 100kW to 1MW, expansion of the period for calculating net use from one to three years, a cap on total cumulative contribution from Net Metering facilities to energy supply in the province set at 20MW, and permission for customers to meter multiple accounts within a defined distribution zone (NSDE, 2009). Despite the increased turbine capacity to 1MW, respondents seven, ten, and sixteen suggested that Net Metering in the province does not encourage the development of economically viable projects. Net Metering regulations simply allow consumers to turn their meter back to zero. As a result, consumers are unable to profit from excess electricity produced and must provide NSPI with any excess power produced at the end of a three-year billing period, free of charge. Although the price is fair, as it is the price the consumer would have otherwise paid for a unit of

electricity, this provides an incentive for the developer to generate only the electricity needed by an individual property or small group of properties (Respondent seven and ten). Thus, it was suggested that this program provides a disincentive for the development of turbines that take advantage of economies of scale. Respondent fourteen indicates that although there is no defined project size in Nova Scotia that exploits economies of scale, projects should be at minimum in the 1 to 2MW range. Respondent thirteen also suggested that the absence of net billing was a barrier, restricting an NSPI consumer from exploiting a good quality wind resource on a windy property to power an inland home.

Researcher Recommendations: See Chapter 5 'Regulatory Mechanisms' 'Recommendation 2' surrounding improving the effectiveness of Net Metering in the province.

5. **Government implementation of renewable energy policy through NSPI.** This was noted to be a barrier by respondents one, seven, and sixteen. Renewable energy policy is currently implemented through NSPI, a private company focused upon making profit for its shareholders. It was noted that NSPI acts within a "box of regulations" and must make as much profit as possible in order to be responsible to its shareholders, while still meeting its obligations to the government and consumers (Respondent one). Currently, NSPI is faced with many disincentives associated with adherence to renewable energy policy, including, but not limited to, the loss of market share and absence of profit when contracting IPPs to meet the provincial RES and climate change regulations, the cost of feasibility studies to bring wind projects onto the grid, and the responsibility to demonstrate to the UARB that expenses entering the rate base are just and reasonable (Respondent seven).

Respondent Recommendations: Respondent one noted that it is ultimately up to NSPI's regulators to create the most effective "box of regulations" that includes not only economical considerations, but social and environmental aspects as well.

Researcher Recommendations: It is acknowledged that NPSI holds the majority of the market share and that contracting further IPPs to meet provincial goals and targets results in loss of market share and financial burden associated with project feasibility and grid interconnection studies. Therefore, it is recommended that further research be conducted to determine the actual market share loss and cost of bringing IPPs onto the gird. Taking such research into consideration, new ways of regulating NSPI should be sought which do not create disincentives for compliance with current government policies. For example, instigating penalties for non-compliance associated the failure to meet the RPS would act as incentive for the Company to contract IPPs. However, this does not mitigate the absence of profitability associated with contracting IPPs.

6. **Market policies and practices in other jurisdictions.** This was noted to be a barrier by respondent nine. Should the export of electricity become feasible in Nova Scotia, the province must ensure that their product conforms to the standards and restrictions within other jurisdictions. For example, legislation and regulatory restrictions imposed in the United States (US) will impact Nova Scotia's ability to compete in the US marketplace. The Massachusetts Senate passed '*An Act to Generate Renewable Energy and Efficiency Now*' (2008), which favors instate renewable energy development. Under the Act, local renewable energy is incentivized in numerous ways including making local generation cost effective for individuals, communities, and municipalities and creating a mandatory

framework for utilities to procure 10 to 15 year long-term contracts with primarily Massachusetts based renewable energy developers (EnvMass, 2008; Jesmer, 2008).

Respondent Recommendations: Respondent nine suggests that Nova Scotia's ability to export to other jurisdictions would allow the province to operate within a regional planning system in terms of developing and managing renewable energy sources. "If we think as a region, we'll have a balancing effect," says respondent nine. As such, this ability to balance electrical supply and demand would enable greater development of intermittent wind resources (Respondent nine). Respondent nine indicates no opposition to the export of resources, given that Nova Scotia is favoring community-scale development above exports.

Researcher Recommendations: Given the relatively small, isolated nature of the electricity market and the need for balancing of an intermittent resource, encouraging the export of energy within a 'green' regional marketplace is recommended to increase Nova Scotia's ability to meet a greater percentage of its electrical demand using wind. However, it is recommended that the province ensure community development remains the focus of renewable energy policy and that electrical capacity for export is not derived from increased use and development of conventional fuel sources, including coal, natural gas, and petroleum products. See Chapter 5 'Market Structure' 'Recommendation 10' for further discussion.

Social perception

1. **"Not-in-my-backyard" (NIMYism).** Respondents one, two, six, eight, nine, and fifteen suggested that a certain degree of NIMYism was occurring in Nova Scotia in relation to wind development. It was suggested that this may be the result of a lack of community buy-in and stakeholder engagement in project development, a lack of education and awareness surrounding the scientific grounding behind the issues (i.e. "Real vs. Perceived" or a "fear for what we do not understand") and

the benefits that renewable energy can bring to a community, and lower levels of developer experience (Respondents two, eight, fourteen, fifteen, and sixteen). Respondent six noted that NIMBYism on a whole had decreased within the province. It was suggested that this was a result of extending the engagement of communities and stakeholders in the planning and development process, advising stakeholder groups, minimizing impacts though improvements in technology and science, and increasing levels of public comfort with the technology. Another factor suggested by respondent two, was the advancing experience level of the developer. Respondent two indicated that a developer with a lack of experience within the industry may make many mistakes, such as building turbines too close to homes, which creates a negative perception of wind amongst the public. For example, a family abandoning their home in Pubnico claiming health impacts from a nearby wind farm (Jacques Whitford. 2008). Such incidents ignite fear towards wind technologies within communities.

Respondent Recommendations: Respondent six noted that NIMBYism could be decreased through greater community engagement, improvements in technology and science, and public comfort with the technology. Respondent two goes further to indicate that greater developer experience plays a role in reducing negative public perception towards the technology.

Researcher Recommendations: To assess the accuracy of this barrier, NIMBY statistics in Nova Scotia could be tracked over the past decade and discussions with community members could be conducted to determine the systemic causes of negative perception surrounding wind. Further discussion surrounding public education programs to alleviate the ‘real vs. perceived’ concerns and the fear surrounding the impacts of a poorly understood technology can be found in Chapter 5 'Public Education Tools' 'Recommendation 15'.

2. **Apathy.** Respondent one indicated that apathy was also an issue, in association with those aware of the problems and potential solutions, but who have no intention of initiating change.

Researcher Recommendations: Apathy is likely behind the inactivity of a certain percentage of the population. However, a lack of education and awareness surrounding where and how our energy is generated and the associated externalities is also felt to be a major barrier contributing to lack of public support for greater development of wind and other renewable technologies.

Technical constraints

1. **Weaknesses of the electrical gird and inter-tie.** This was noted to be a major constraint by respondents one, two, three, five, six, seven, eight, nine, eleven, twelve, fourteen, and sixteen. Currently, Nova Scotia is able to export 300MW to New Brunswick and receive 350MW of imports from its neighbour (Figure 2). Alternatively, New Brunswick is able to import 50MW and 1,100MW from New England and Quebec, respectively (Figure 2). Exports to both New England and Quebec amount to 700MW (Figure 2). Furthermore, respondents five and eleven suggested that the grid within the province requires upgrading to ensure reliability and stability. Respondent eleven

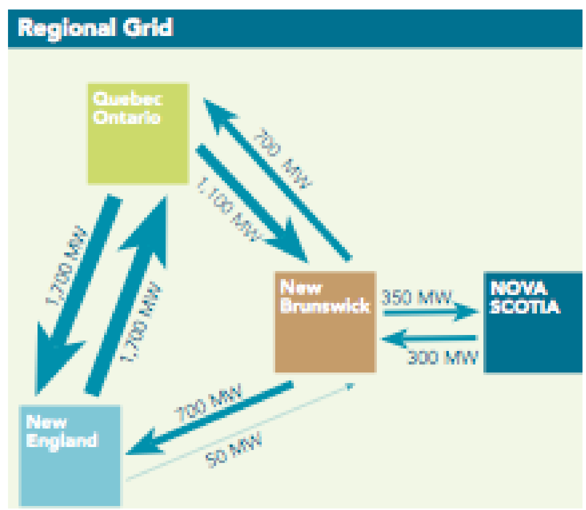

Figure 2. The regional grid and inter-tie capacity (NSDE, 2009).

raised concerns regarding the implications of significant amounts of wind generated electricity being added at one location on the grid (i.e. 4-5MW), resulting in voltage problems that could pose issues for power quality in the area. Respondent fourteen recognized that larger scale wind development requires three phase electrical lines to transport the electrons from source to demand. Should grid technology not extend to rural areas of the province, this would pose a barrier preventing development of larger scale wind farms and economically viable project sizes for distributed wind in remote locations. Respondents pointed to the Hatch (2008), wind integration study to confirm that further technical studies and potential grid upgrades would be required to move beyond the 2013 RES, with an estimated 581MW of wind capacity. A lack of knowledge surrounding current grid capacity was also highlighted as a barrier by respondent eleven. This respondent indicated that developing an understanding of the technical implications associated with adding wind to the electrical grid is a slow process, as small amounts of wind must be incorporated and the implications understood and managed, prior to adding the next small increment, until the desired quota it achieved.

Researcher Recommendations: The Hatch (2008) study confirms that further studies and potential grid upgrades will be required to move beyond 581MW of wind energy within the current grid infrastructure in Nova Scotia.

2. **NSPI thermal generation assets.** This was suggested to be a barrier by respondents five, six, eight, and nine. NSPI has a number of thermal generating plants with many years of life remaining, which if shut down, would become

stranded assets. Concern was raised over the implications that this may have upon the ratepayer, as the cost of capital assets borne by NSPI is transferred to the price of electricity. Additionally, respondents five and six indicate that the current thermal generating plants in Nova Scotia were not designed to be load followers, as they are difficult to ramp-up and ramp-down in response to supply and demand. The intermittency of wind makes generating accurate forecasts difficult, and thus, rapid response generating facilities are required to follow the load (Hughes, 2007). Respondent six also noted the integration of wind would present a challenge to the system operator who must balance load (supply and demand) in real-time.

Researcher Recommendations: When establishing the rate base, the UARB includes the value of the physical assets of the utility used and useful in furnishing, rendering, or supplying a service to the public and the reasonable and necessary cost of labour and supervision (PUA, 1997; UARB, 2008c). The UARB may also make allowances for the inclusion of the following in the rate base: necessary working capital, limited organizational expenses, limited construction overheard, and the costs of land acquired in reasonable anticipation of future requirements (PUA, 1997). However, in these instances, NSPI must demonstrate to the UARB that expenditures are reasonable and prudent (PUA, 1997). As such, the capital cost of current thermal generation assets are included in the rate base and NSPI will be entitled to receive a return on this rate base that the UARB deems ‘just and reasonable’ (UARB, 2008c). Accordingly, the financial burden associated with stranded assets would be transferred to the ratepayer through the price of electricity.

Cost

1. **Capital-intensive development and high-risk exposure.** All respondents noted that wind development was capital intensive and involved high levels of risk exposure. Many developers, specifically smaller to medium scale (<2MW) find it difficult to obtain financing (Respondents five, six, nine, and sixteen). The current global recession was suggested as a factor contributing to increased difficulty in finding financing (Respondent two, five, and thirteen). However, respondent one noted that the business structure was flawed from the beginning, as a result of the lack of long-term certainty surrounding price per kWh and the provincial and federal policy regarding renewable energy.

Respondent Recommendations: The provision of greater levels of government support through incentives and rebate programs was identified as an adequate solution to reduce the risk associated with capital-intensive wind development (Respondents one, eight, nine, ten, twelve, thirteen, and sixteen). Respondent sixteen added that further incentive programs would also attract wind turbine manufacturers to Nova Scotia.

Researcher Recommendations: It is acknowledged that wind development is capital intensive and associated with higher investment risk due to a lack of long-term project visibility. According to CanWEA, each MW of installed wind capacity requires approximately C$2.3 million in capital investment (varying based upon wind speed, connection costs and rules, different foundation and tower requirements, and different PAAs) (CanWEA, 2008a; CanWEA, 2003). However, the cost of wind energy has decreased 80 percent over the last 20 years (AWPC, 2005). In the 1980s, wind generated electricity costs were approximately US$0.30/kWh (AWPC, 2005). In 2005, CanWEA predicted that new wind technologies when applied on good quality wind sites in North America, could generate electricity for less than US$0.05kWh

(AWPC, 2005). Accordingly, with the falling capital cost coupled with government support through the provision of rebates and incentives, the risk associated with wind development can be reasonably foreseen to decrease. See Chapter 5 'Fiscal Tools' 'Recommendations 7 and 8' for discussion surrounding government incentive programs.

2. **Lack of valuation for externalities.** Respondents four and ten indicated that the lack of valuation of externalities, both positive and negative, was as a flaw within the current system for pricing a kWh of electricity. Respondent four noted that our power bill does not represent the life-cycle cost of the electricity we consume. Instead these external costs, or externalities, are borne by individuals and other systems.

Respondent Recommendations: Respondent nine suggested that full cost accounting be utilized to assess the value of a kWh of electricity. Such a price would take into account both the negative and positive externalities associated with our energy sources. Respondent one suggests that a consultant be hired to study the life-cycle cost of energy and give credit for environmental and social externalities.

Researcher Recommendations: It is acknowledged that the current valuation of a unit of energy does not take into account positive and negative externalities or life-cycle cost. For example, the health care system is burdened with negative externalities associated with the burning of coal, oil, and natural gas in Nova Scotia (SWI, 2007). Emissions from electricity generation lead to health issues including respiratory illness, cardiovascular disease, allergies, and neurological effects (SWI, 2007). Should the externalities be valued when pricing a kWh of electricity, renewable energy sources have the potential to be a competitive or superior alternative to fossil fuels. Further research is required to assess the life-cycle cost of both conventional and renewable energy sources in order to arrive at a price per kWh that incorporates externalities.

3. **The definition of the 'cost' of a kWh.** This definition was noted to be too narrow by respondent four, encompassing only the, 'price of a kWh today'. Requests by NSPI to increase the rate base and/or the price of electricity are subject to the oversight of the UARB, a body mandated to ensure that NSPI expenses are reasonable and prudent (UARB, 2008c). Within this process, NSPI is mandated by the UARB to procure energy sources at the lowest cost. Respondent four and eleven suggested that the emphasis placed upon 'lowest cost' is a shortsighted way of thinking when comparing renewable sources to conventional energy.

Respondent Recommendations: Respondents one, four, and seven suggested that longer term thinking would reduce the focus placed upon 'lowest cost' today, as renewable energy will likely prove to be a better investment over the long-term as the price of fossil fuel inevitably increases. Respondent one suggested hiring a consultant to study the long term cost of a unit of energy, for both conventional and renewable sources, and give due consideration for externalities when suggesting an appropriate price per unit of electricity in Nova Scotia. Respondents one, three, nine, twelve, thirteen, and sixteen noted that a FIT would support longer-term thinking.

Researcher Recommendations: To assess the accuracy of this barrier, it will be necessary to determine the criteria that the UARB uses to define 'lowest cost' when assessing a request from NSPI for an increase in the price of electricity. Such criteria should include valuation of the negative and positive externalities associated with both renewable and conventional energy sources.

4. **The lack of long-term price visibility**. Respondent seven suggested that this barrier limits the financing available and long-term PPAs that can be acquired in Nova Scotia. Should IPPs have the ability to connect to the grid and sell their electricity, which they currently do not, this lack of long-term price visibility would also pose a concern for attaining PPAs with developers in other jurisdictions.

Respondent Recommendations: Respondents two, four, nine, fifteen, and sixteen, indicated that a FIT would increase the project price visibility, thus, mitigating the barrier associated with limited financing and limited ability to obtain PPAs.

Researcher Recommendations: It is acknowledged that lack of a price visibility increases investor risk, and thus, can reasonably be foreseen to result in fewer financing opportunities and long-term PAAs if the return on investment does not compensate for the risk. Furthermore, it is agreed that a fixed price per unit of energy would provide longer-term project price visibility, and thus, reduce the risk for both the investor and the developer. Increasing investor return on current projects would serve as an approach to attract investors to higher-risk projects with lower visibility. However, this approach would likely place a financial burden on wind developers if they are not able to secure a price per unit of electricity adequate to cover development and operating expenses, investor return, and yield profit. Further research will be needed to assess the ability of the current developer in Nova Scotia to generate wind electricity at a profit, while providing investors with a return adequate to compensate for the risks involved.

5. **Payback period.** Respondent eleven suggested that the payback period associated with wind development on the smaller scale, approximately five to ten years on average, was an issue for consumers who were concerned with affordability,

limiting those able to participate in the development of the industry. For example, this respondent indicated that the penetration rate within NSPI's Net Metering program remains low, at about two out of every 300 customers as of February 2008. However, respondent thirteen noted that the current payback period and net present value of a turbine was based upon short-term thinking (five to seven years). This respondent went further to indicate that the concrete foundation and pole represent the majority of capital assets associated with a wind development, and rarely require repair or replacement. Given inflation, a turbine may be worth more in ten years than it is now, providing an incentive for developers to invest in such assets (Respondent thirteen).

Respondent Recommendations: Respondent thirteen recommends rebates and tax incentives to decrease the payback period facing wind developers and encourage longer-term thinking.

Researcher Recommendations: It is acknowledged that the payback period for wind development on a smaller-scale is a barrier for those concerned with short-term affordability. Furthermore, it is agreed that rebates and tax incentives will reduce the capital burden on wind developers and thus, reduce the payback period associated with development. See Chapter 5 'Fiscal Tools' 'Recommendation 4, 5, 7, and 8' for discussion surrounding property tax restructuring, accelerated tax depreciation, and government incentive programs that will act to reduce the payback period and increase affordability.

6. **Cost of infrastructure upgrades.** Respondent nine notes that although uncertainty surrounds the topic, upgrading the current infrastructure will likely be costly. Accordingly, the high cost of infrastructure upgrades limits what can be

feasibly undertaken by NSPI and the ratepayers alike, in the way of maintenance, reinforcement, and expansion of the current system (Respondent nine).

Researcher Recommendations: Conduct further studies to define the cost and technical implications of adding more than the 581MW of wind electricity to the grid, as required to achieve the 2013 RES.

Transparency

1. **Administrative complexity.** Respondents fifteen and sixteen noted this to be a barrier. Respondent sixteen indicated that wind turbine developers are exposed to administrative complexity at all stages of the process, including, but not limited to, finding an appropriate site, entering into agreements with NSPI, interconnection and project feasibility studies, the environmental assessment process, land leases, and equipment selection. Due to the complexity, wind development requires a significant investment of time and capital, which may be lost should the project fail to be realized (Respondent sixteen). Respondent fifteen indicated that the current procedures surrounding grid interconnection are very complex and difficult for the average developer to grasp. This was noted to be limiting to smaller players (Respondent fifteen).

Respondent Recommendations: Respondent fifteen suggested that NSPI publish uniform, transparent grid interconnection standards for the public to view. Furthermore, this respondent recommended that grid information be made publicly available. Such a step would enable developers to become better informed and potentially identify locations where the grid could be strengthened through the addition of incremental wind generation (Respondent fifteen).

Researcher Recommendations: It is acknowledged that the current RFP process is administratively complex. With regards to transparency of gird interconnection standards, the following documents are posted publicly: Standard Generation Interconnection Procedures (GIP), Generator Interconnection Request Form, Feasibility Study Agreement, System Impact Study Agreement, Facilities Study Agreement, Optional Interconnection Study Agreement, and Standard Generator Interconnection & Operating Agreement (GIA) (NSPI, 2005b). Thus, it can be concluded that procedures are publicly available. Alternatively, grid information could not be found within the public domain. Therefore, it is acknowledged that the availability of grid information for developers to review could potentially benefit both NSPI and the developer, through strengthening the grid and increasing the efficiency of turbine siting.

Market Structure

1. **Isolated market**. The electricity market in Nova Scotia is poorly connected with its neighbour New Brunswick, through a 350MW import and 300MW export inter-tie (NSDE, 2009). The small market dynamic was noted to make it difficult for wind resources to be added to the current electricity mix without increasing supply, and thus, unsustainably encouraging increased demand (Respondents one, two, three, five, six, seven, eight, nine, eleven, twelve, fourteen, and sixteen).

Respondent Recommendations: Respondents two, nine, and twelve, signaled support for the regional extension of the current electrical generation market in Nova Scotia. This situation was suggested to enable a greater percentage of electrical demand to be met using intermittent wind resources, through load balancing across a larger region.

Researcher Recommendations: See Chapter 5 ‘Market Structure’ ‘Recommendation 10’ for discussion surrounding the creation of a ‘green’ regional marketplace.

2. **Small demand.** Annual electrical demand in Nova Scotia is 13 terrawatt hours (TWh) (EAEA, 2008). Comparatively, annual demand is 17TWh in New Brunswick and Prince Edward Island, 188TWh in Quebec, and 127TWh in New

England (EAEA, 2008). Nova Scotia's comparatively small demand was noted to be a barrier by respondents two, four, nine, and eleven. Lower demand was suggested to leave little capacity to handle electrical inputs from wind, given the thermal generating assets that currently meet electrical demand in the province. Respondents nine, ten, eleven, and twelve indicated that the smaller market size also limits the spin-off industry that can develop, as it is not large enough to offer significant commercial opportunity. For example, in Quebec manufacturing of wind turbines took place alongside 400MW installed wind capacity (Seibold, 2008). Nova Scotia currently has 61MW of generating capacity (NBSO, 2008).

Respondent Recommendations: Respondents two, nine, and twelve, signaled support for the regional extension of the current electrical generation market in Nova Scotia. Regional extension was suggested to increase the percentage of electricity that could be derived from wind within the province, as regional load balancing could be used to more effectively balance supply and demand over a larger area.

Researcher Recommendations: See Chapter 5 'Market Structure' 'Recommendation 10' for discussion surrounding the creation of a 'green' regional marketplace.

3. **NSPI virtual monopoly.** NSPI owns and/or operates 97 percent of generation, 99 percent of transmission, and 95 percent distribution in the province (Lipp *et al.,* 2006, Hatch, 2008; Tu, 2005). Currently, approximately 1.6 percent of the marketplace is open for wholesale competition, as the six municipal utilities have the option to purchase some or all of their electricity from suppliers other than NSPI (UARB, 2008a; Hughes, 2007). The virtual monopoly held by NSPI was

identified as a barrier by respondents one, two, three, four, seven, nine, ten, fourteen, fifteen, and sixteen.

Respondent Recommendations: Respondents one, three, four, seven, and fourteen suggested that the introduction of more competition within the market place would reduce the monopoly held by NSPI and potentially benefit consumers, should the price of electricity provided by IPPs be lower than the NSPI rate. It is noted here that the current price of electricity from NSPI is based upon the floating average cost of power generation, and as such, is subject to volatility (Livingston, 2007). Respondent seven indicates that bilateral contracts between the six municipalities and IPPs would offer the municipality a fixed price over time, reducing volatility, and provide the IPP with a long-term customer. It is noted here that IPPs are entitled to enter into such financial contracts with any of the six municipalities that operate their own distribution system (Tu, 2005).

Researcher Recommendations: The Electricity Governance Committee (EMGC) Recommendation 51 states that:

> "The EMGC recommends that any seller offering electricity from renewable resourced using facilities constructed in Nova Scotia after 2001 be able to sell directly to electricity consumers" (Government of Nova Scotia, nd).

As such, allowing IPPs to develop wind projects for personal gain would likely increase the amount of wind projects deployed within the province and create a greater sense of community ownership and acceptance. Further research will be required to determine whether IPPs and municipal utilities may engage in bi-lateral contracts when the transaction occurs beyond the municipalities distribution system. For example, when the IPP is outside of the municipalities distribution system and requires the use of NSPI's transmission and/or distribution infrastructure to transport electricity to the municipal utility.

4. **No right to connect or sell.** Beyond the 1.6 percent of the market open to wholesale competition, the market remains closed to IPPs looking to deploy wind technologies for personal gain. IPPs are unable to connect to the grid in order to send electricity to an end consumer, as NSPI will purchase this power at a wholesale price upon entrance into the grid. This was noted to be a barrier by respondents one, three, four, seven, ten, fourteen, and fifteen. Given that NSPI owns the majority of transmission, distribution, and generation there are few options for consumers and little competition in the marketplace (Respondent one). Furthermore, it was noted that NPSI has little incentive to open the market for greater competition, as this would result in the loss of market share (Respondent one).

Respondent Recommendations: Respondents one, ten, and fifteen suggested decoupling of the transmission and distribution system from retail and sales, should the provision of electricity be considered a fundamental right within society. Accordingly, respondent fifteen recommended consideration for legally redefining the transmission and distribution system, creating a body whose only interest lies in the determination of where electrons flow. Respondent ten further noted that as a fundamental right, the transmission and distribution of electricity should be within government (societies) control, providing grid access to anyone who chooses to generate electricity in an environmentally and/or socially responsible manner. Respondent fourteen noted that in order to maximize the benefits or renewable energy in Nova Scotia, the province must use a mechanism that provides Nova Scotian's with the right to connect to the grid and sell electricity. Provision of the right to connect to the grid and sell electricity would encourage distributed wind and community cooperatives.

Researcher Recommendations: See Chapter 5 'Utility Restructuring' 'Recommendation 12' for further discussion.

5. **Limited profitability of NSPI.** In order to increase profits, NSPI must convince the UARB to allow it to increase its rate base, or allowable rate of return on electricity sales (Respondent seven). Given that NSPI is a privately owned utility, it has a responsibility to its shareholders to make a profit. Respondents noted that this was an appropriate goal, given that NSPI is operating within a capital market. However, concern was expressed by respondent ten regarding how NSPI would balance its commitments to the province and electricity consumers, while still yielding adequate levels of profit. Respondent ten suggested that as a result of the limited profitability of the utility, the company would attempt to keep internal costs low in order to yield profit for shareholders. Accordingly, respondent ten indicates that corners may be cut with regards to grid maintenance and upgrades, resulting in a reactive approach to the grid investment in Nova Scotia.

Respondent Recommendations: Respondent seven suggests that the government should explore new ways to regulate NSPI's rate of return.

Researcher Recommendations: The UARB will only allow an annual return on the NSPI rate base that is 'just and reasonable', generally equal to the rate of return received by other Canadian investors on investments of similar risk (UARB, 2008c). As such, the rate of return received by NSPI, or the company's profitability, is independent of its internal servicing costs. NPSI cannot achieve higher profitability through minimizing servicing costs. Instead, NSPI must increase it's rate base by demonstrating to the UARB that additional expenses are 'just and reasonable' prior to increasing the rate of return.

6. **Lack of incentives for NSPI to engage in efficiency improvements.**

   Respondent seven noted that NSPI faces difficult issues internally. Should NSPI increase their efficiency, a new performance benchmark will be set that may be regulated. As such, NSPI may be in a position where they are regulated to meet this efficiency target with pressure from consumers. Respondent seven concludes that this does not provide a clear incentive to encourage NPSI to engage in efficiency improvements.

Researcher Recommendations: To determine the accuracy of this barrier, further research must analyze the procedures utilized by the government when setting efficiency targets for NSPI. Specifically, in determining whether the government considers NPSI's past performance as a benchmark from which performance targets can be generated.

Government Support

1. **Lack of long-term, transparent vision and commitment on behalf of government to renewable energy development.** This was identified as a barrier associated with both provincial and federal government by respondents three, six, seven, eight, nine, twelve, and fourteen.

Respondent Recommendations: Respondent twelve notes that although the government has invested in the creation of a policy environment for renewable energy development in Nova Scotia, longer-term policies are required. Respondent nine indicates that a long-term policy environment is required for project planning, as developers need to know that the government will support them through incentives or the regulatory structure. Furthermore, a long-term policy environment must also be coupled with key policy drivers, including, but not limited to, a cap and trade program and carbon tax (Respondent nine). Respondent twelve suggested that a clear signal of government commitment and the long-term visibility of the wind industry would result in job creation and spin-off industry.

Researcher Recommendations: It is acknowledged that the government has taken a positive step towards the creation of longer term, transparent vision and commitment to the development of renewable energy technologies and climate change mitigation. Consider the *Electricity Act* (2004), in which the province was given the legislative power to enact a mandatory RPS (Bradely, 2005). Furthermore, the Nova Scotia enacted *Environmental Goals and Sustainable Prosperity Act* (2007) that set forth provincial goals to reduce greenhouse gas (GHG) emissions by10 percent of 1990 levels by 2020; a reduction equivalent to 5 megatonnes (Hatch, 2008; NSDEnv, 2009a). GHG targets were expanded upon in the Climate Change Action Plan (2009) to include 80 percent reduction in GHG and air-pollutant emissions by 2050. Renewable energy goals include the Nova Scotia RES under the *Electricity Act* (2007), creating renewable energy targets for 2010 and 2013. These targets were expanded in the Energy Strategy (2009), requiring that the province produce at least 25 percent of electricity from renewable sources by 2020. However, it could be argued that the policies do not demonstrate an adequately long-term commitment. The importance of long-term vision and commitment is derived from the need for developers and investors to be confident that they are investing within an industry that is growing in both size and profitability, and will not dissolve in 10, 20, or 30 years and beyond. A longer-term policy environment can lead to a reduction in investment risk and increased development of wind and other renewable technologies.

On the federal level, an example of the lack of long-term commitment was noted in the failure to extend the ecoENERGY for Renewable Power Program (ERPP) within the 2009 Federal Budget (CanWEA, 2009). This program has been an important stimulus for wind energy development in Canada, providing $0.01 per kWh of renewable energy generated (CanWEA, 2009). See Chapter 5 'Fiscal Tools' 'Recommendation 8' for further discussion.

2. **Lack of ability to compete in other jurisdictions.** A concern raised by respondent nine surrounded Canada's ability to continue to compete with the US for investment in wind energy. The US has set forth clear instructions for renewable energy development as a component of their 2009 economic stimulus package (CanWEA, 2009). For example, under the Obama administration, 25 percent of electricity in the US must come from renewable sources by 2025 (Change.gov, 2009).

Researcher Recommendations: It is acknowledged that failure to comply with market practices and polices in other jurisdictions will limit Nova Scotia's ability to compete in the export market, should infrastructure, electrical supply, and government policy permit such activity.

3. **Lack of government investment in renewable energy.** This was noted to be a barrier by respondent eight and ten. Respondent ten suggested that the government must invest in every level of wind development, from education and training of a skilled work force to the research and technology that drives the industry. It was suggested that an expert workforce and advanced technologies are essential for the development of an effective wind energy regime.

Respondent Recommendations: Respondents eight and ten both recommended greater investment in the renewable energy industry as a whole: from the training of an expert workforce to the development of efficient and effective technologies. Such investments, they claimed, would act to reduce our dependence on volatile fuel sources, build expertise locally, avoid NIMBYism, and lead to technology and efficiency improvements.

Researcher Recommendations: It was noted that the 2009 Energy Strategy pledges an additional C$18.8 million in investment towards research to better understand the offshore geological potential and share these results with industry and public, with C$22 million to date in support of the Offshore Energy Technology Research association and C$8 million to date in support of Offshore Environmental Research. Alternatively, the province pledged C$5 million to support the Fundy tidal demonstration centre and C$9.5 million to support ecoNova Scotia's Environmental Technology Program (NSDE, 2009). Although investment in renewable technologies exists, it is less extensive than investment within the conventional oil and gas sector. See Chapter 5 'Recommendation 15' for discussion surrounding government investment in educational and training programs relating to renewable energy development.

Research and Development

1. **Lack of technology to create bankable wind maps.** Nova Scotia has a wind map of excellent quality. However, a barrier relevant to all jurisdictions lies in the lack of a technology currently available to generate a map that will provide wind data accurate enough to satisfy a bank or other project financer (Respondents three, fifteen, and seventeen). Furthermore, respondents eight and seventeen noted that the current wind map is missing characteristics of a holistic wind planning tool, including land access, municipal bylaws, community relationships, and the ecological sensitivity of an area. The cost associated with data collection was also noted to be a barrier by respondents three, fifteen, sixteen, and seventeen. At project onset, a wind tower must be erected for site-specific data collection, in addition to collecting information from other reputable sources, including Environment Canada to yield more accurate results (Respondent 17). Wind towers can vary in cost depending upon the tower size; with small towers cost

approximately C$15,000 to commercial scale towers of approximately C$60-75,000 (Respondent three).

Respondent Recommendations: Respondent seventeen suggests that further investment be allocated towards research and development of technologies for mapping and modeling the nature of wind resources in Nova Scotia, with focus placed upon ensuring repeatability, accuracy, and reproducibility of data collected. Respondent seventeen also suggested that such maps be increasingly holistic, incorporating themes beyond the nature of the wind resource, including land access, municipal bylaws, community relationships, and the ecological sensitivity of an area.

Researcher Recommendations: See Chapter 5 'Research and Development Tools' 'Recommendation 13' for further discussion.

2. **Lack of economical means for storing electricity.** This barrier was presented by respondents eight and nine. Without such storage devices, electricity must be generated in real time to balance supply and demand. Given that such a balance is unrealistic when dealing with intermittent wind resources, back-up sources of electricity are needed.

Respondent Recommendations: A potential solution suggested by respondent nine includes greater use of electric thermal storage units that convert electrical energy into thermal energy for home heating. This technology offers a potential option for the use of excess electricity generated from wind (Hughes, 2007).

Researcher Recommendations: See Chapter 5 'Research and Development Tools' 'Recommendation 14' for further discussion.

Intermittency

1. **Intermittency.** This was noted by respondents five and six, thus limiting the penetration of wind within the electrical power generation sector. Respondent six reasoned that intermittency was a barrier due to winds capacity factor close to 25 percent, a value lower than other non-renewable and renewable sources including biomass (Hughes, 2007). As such, inclusion of wind within the current electrical system may lead to system stability and reliability concerns (Respondent five) and intensify the challenges associated with balancing supply and demand (Respondent six). Respondents five, six, eight, and nine agreed that integrating wind into the current system built around a non-dispatchable load would prove time-consuming and costly.

Researcher Recommendations: It is acknowledged that, as the nature of the wind resource, intermittency will always be a barrier, and thus, cannot be eliminated. However, intermittency can be mitigated with technological advancements, such as economical electrical storage technologies and demand side management options as discussed in Chapter 5 'Research and Development Tools' 'Recommendation 14' and 'Intermittency and Coincidence' 'Recommendation 16'.

Turbine Impacts

Impacts associated with turbine development, as discussed below, were addressed by respondents fourteen and fifteen.

1. **Environmental turbine impacts.** Impacts include, degradation of habitat (specifically, ecologically sensitive areas along the coast of Nova Scotia where the wind potential is the greatest), wildlife harm (specifically, ecologically sensitive populations), and bird and bat kills. It should be noted that these concerns were presented with regard to both the

erection and operation of the turbine, in addition to the construction involved with the creation of supporting infrastructure (i.e. access roads and fences). Other environmental impacts of turbine development addressed in the current literature include, erosion, as turbines are sited on hills to take advantage of the wind and the construction of access roads can lead to soil disruption, the potential for an oil spill resulting from the leaking of a small amount of oil contained with the gearbox of the nacelle, and the potential for a fire to occur as a result of structural failure, lightening, or storm action (Jacques Whitford, 2008).

2. **Other turbine impacts.** Barriers identified by interview respondents include shadow flicker, a visual impact resulting from the sun passing behind the blades of the turbine, noise concerns of residents within the area, reduced aesthetic quality, and property value reduction. Other impacts of turbine development addressed in the current literature include, infrasound (experienced through vibrations) and amplitude (low frequency modulation of a wide set of frequencies) modulation, aviation safety, telecommunication and electromagnetic interference, increased traffic, construction of access roads, blade throw, where the whole blade or part of the blade becomes detached from the turbine and is thrown through the air, and ice throw, where ice fragments are thrown from the blade of an operational turbine (Jacques Whitford, 2008).

Researcher Recommendations: See Chapter 5 'Public Education Tools' 'Recommendation 15' for further discussion surrounding the 'real vs. perceived concerns' and the need for an understanding of the science behind advancing technologies.

Chapter 5

Overcoming the Barriers

Introduction

This chapter presents a number of recommendations capable of overcoming or mitigating a select number of barriers discussed in Chapter 4. The recommendations focused upon regulatory tools, fiscal tools, market structure, utility re-structuring, research and development tools, public education tools, and intermittency and coincidence.

Regulatory Tools

Recommendation 1: Permanently integrate a feed-in-tariff (FIT) for smaller scale wind generation within the current request for proposal (RFP) process. Alternatively, and less ideally, avoided cost purchasing could be used in the place of a fixed price for a unit of electricity.

Electrical Sector Goals Achieved: A 'Fair/Competitive Price', 'Increased Affordability', 'Grid Stability and Reliability' as distributed generation may strengthen weaker points on the grid.

Throughout this section, neither a FIT nor the RFP process will be suggested as the superior approach to meeting Nova Scotia's current Renewable Portfolio Standard (RPS). Instead it is recommended that a combination of these policies be used within Nova Scotia to encourage greater penetration of wind technologies. It is suggested that Nova Scotia Power Incorporated (NSPI) offer a separate RFP process for smaller scale wind and other renewable generation in the form of an FIT (standard offer contract). This will provide smaller scale wind developers with the project price visibility they need to acquire financing and alleviate some of the risk that they must take with a limited supply of capital. NSPI created a similar standard offer contract program in 2004, issuing an RFP for 20 megawatts (MW) from projects of 2MW or less (Lipp, 2007; English, 2009). The fixed price was set between C$0.068 and C$0.072 per kilowatt-hour (KWh) (Lipp, 2007; English, 2009). Although NSPI had originally intended to accept bids up to a combined total of 20MW, at the conclusion of the program NSPI had signed 26MW (Lipp, 2007; English, 2009). In the fall of 2007, NSPI issued a subsequent RFP for 15 to 30MW from small projects, with no standard size defined (Lipp, 2007). Given the success of this program, it is suggested that it is integrated permanently within the current RFP process. According to NSPI, this program is still available and the utility is willing to entertain bids at the posted price (English, 2009).

Should this program be incorporated within the RFP process, it is suggested that wind developers be offered a price closer to C$0.10 to C$0.13 per kWh. Interview respondents indicated that this fixed price is appropriate for sustaining the wind industry in the province. For example, the successful standard offer contract in Ontario offers developers a price of C$0.1108 per kWh (English, 2009). It is noted here that the appropriate price for a FIT will vary based upon location, maturity of the technology, resource availability, and the scale of the project (Lipp, 2008). Alternatively, avoided cost[6] purchasing by utilities could be utilized to provide wind developers with a fair price for a kWh of electricity. This could include a small administration fee to cover the linguistics. Avoided costs harms neither the utility nor developer, as the price per kWh remains at what it would otherwise have been if the utility had produced the electricity. As such, it does not harm the ratepayer by driving up the price of electricity. Avoided cost purchasing enables advancement of carbon goals if the electricity is secured from a renewable source and offers a mechanism capable of encouraging community-scale development. Although it offers a fair price for a kWh, it is not as ideal as a FIT as the avoided

[6] Avoided cost is the cost the utility would have incurred had it supplied the power itself or obtained it from another source (EPSA, 2009).

cost can vary, subjecting the investor and the developer to greater risk than would be experienced with a FIT.

With regards to appropriate turbine size, consideration must be given for market specific conditions, including but not limited to, grid capacity and availability of turbines themselves. Should the turbine size limit be too large, larger wind players may continue to dominate the smaller scale market and eliminate the potential benefit for smaller scale projects that still exploit economies of scale (>1-2MW). Furthermore, grid capacity is an issue when adding intermittent electricity sources. It has been suggested that moving beyond the Renewable Energy Standard (RES) for 2013, approximately 581MW of wind, will require further study and potential infrastructure upgrades (Hatch, 2008). As such, turbine size limit must enable a variety of actors to benefit from the RFP process across the province, while still ensuring that wind capacity remains below 581MW until further analysis has been conducted. Finally, turbine availability in the province will limit the realistic project size.

In California, a similar cost-based FIT is being considered for renewable projects up to 20MW (KEMA, 2008). In this program, cost would be differentiated by technology and size (KEMA, 2008). The program was suggested to address issues similar to those faced in Nova Scotia, as the competitive solicitation process in California has done little for developments below 20MW (KEMA, 2008).

Overall, a separate RFP process for smaller scale developers would result in a decreased need to open the market to competition in order to achieve greater penetration of smaller scale, distributed wind projects within Nova Scotia.

Recommendation 2: Continue to improve the current Net Metering program with consideration for best practices from other jurisdictions.

Electrical Sector Goals Achieved: A 'Fair/Competitive Price', 'Increased Affordability', 'Grid Stability and Reliability' as distributed generation may strengthen existing weak points on the grid.

The improvements made to the Net Metering program within the 2009 Energy Strategy signaled a positive step. According to Lipp (2007), driving community wind development through Net Metering requires additional incentives and/or extended allowances for project size, and compensation for excess power and siting. The following recommendations by Lipp (2007) are supported:

- Extending the current 1MW project size limit to achieve greater economies of scale and ensure that developments are economically viable. It is indicated that greater economies of scale are achieved through the development of projects larger than approximately 1-2MW. Lipp suggests that best practices in Net Metering point to a 2MW project size limit as common, with some jurisdictions allowing as much as 80MW.
- Expand the current 20MW cap on total provincial Net Metering, given that this cap remains within the technical limits of the system. The Hatch (2008) report indicates that the current system can handle 581MW of wind capacity without upgrades, however, moving beyond this point will require further analysis. Lipp (2007) notes that many American states do not impose a system limit on net metering.

- Compensation for excess power produced at the end of a 3-year rolling period with a fair price per kWh. Lipp (2007) suggests that the level of compensation could be set at the full-avoided cost rate as done New Jersey, USA, a jurisdiction that saw Net Metered customers jump from zero to 3,000 within four years of implementing new market rules for Net Metering.
- In the 2009 Energy Strategy, the government indicates that it will, "allow customers to meter multiple accounts within a defined distribution zone". It appears that this satisfies the suggestion by Lipp (2007) surrounding allowing generation on a single site to serve multiple sites. However it remains unclear whether this includes the separation of the site of generation from the site of use (net billing). Net billing would enable a customer to exploit wind resources on a windy property in order to power their inland home. Additionally, the definition of "defined distribution zone", remains unclear and should be further defined.

It is noted here that compensation for the electricity consumed at the end of a 3-year rolling period, in addition to an increase in the project size limit and the cap on the allowable kWh from Net Metered projects in the province, would achieve electricity sector goals similar to those in Recommendation 1. Accordingly, the before mentioned improvements to the Net Metering program in Nova Scotia could be completed as an alternative to the creation of a FIT for smaller scale generation within the current RFP process.

Overall, improvements to the current Net Metering program are positive. However, as of September 2008, there were only 13 net metering customers in Nova Scotia (English, 2009). It remains to be seen whether current improvements will encourage greater use of the program. The government and NSPI should continue to search for ways to improve the program to better enable economically viable wind development within the province.

Recommendation 3: Support the market price on carbon under the new federal "Regulatory Framework for Industrial Greenhouse Gas Emitters" and the provincial Greenhouse Gas (GHG) caps on NSPI in light of leveling the 'playing field' between conventional fuel sources and renewable generation.

Electrical Sector Goals Achieved: A 'Fair/Competitive Price', 'Increased Affordability'.

It is suggested that wind power is an attractive technology to develop should fuel prices remain in the US$60 to US$120 per barrel of oil range; lower fuel prices leave carbon dioxide (CO_2) regulation and a RPS as the main economic drivers behind development (EAEA, 2008). With the RPS firmly in place within Nova Scotia, CO_2 regulations are not far behind given the development of a federal plan that is intended to create an appropriate price for carbon in the market, the "Regulatory Framework for Industrial Greenhouse Gas Emitters" (Denstedt *et al.*, 2008). The plan will take effect in 2010, setting up a carbon emissions trading market complete with carbon credits and offsets (Denstedt *et al*., 2008). Economic modeling for the regulatory framework predicts carbon prices to be C$25 in 2010, C$50 in 2016, and C$65 in 2020 (Denstedt *et al*., 2008). This price on carbon acts as a disincentive, clearly signaling to industry that investment in renewable technology will be required and rewarded.

On a provincial level, the Climate Change Action Plan (NSDEnv, 2009a) aims to reduce GHG emissions by at least 10 percent of 1990 levels by 2020, or five megatonnes annually, with a long-term goal of 80 percent reduction by 2050. The single greatest reduction of GHGs will be achieved through capping emissions from NSPI, currently responsible for 46 percent of the provinces GHG emissions (NSDEnv, 2009a). NSPI will be required to cap GHG and air-pollutant emissions at 9.7 million tonnes in 2010, 8.8 million tonnes in 2015, and 7.5 million tonnes in 2020 (NSDEnv, 2009a). This provides a total reduction of 2.5 million tonnes, down from the approximate 10 million tonnes produced by NSPI in 2007 (NSDEnv, 2009a). It is recommended that provincial and federal plans to reduce GHG emissions be supported as they indicate a positive step forward in light of leveling the 'playing field' between conventional fuel sources and renewable electricity generation. Additionally, longer-term goals and targets should be developed and implemented.

Fiscal Tools

Recommendation 4: Consider restructuring the property tax regime to base taxation on actual production from a wind generation facility, as opposed to the stated maximum output of a turbine.

Electrical Sector Goal Achieved: 'Increased Affordability' thorough a reduction in tax burden on intermittent resources.

It is recommended that the government consider the creation of property tax regime for wind generation that avoids creating a disincentive for development. This could be done through taxation based upon actual production from a generation facility in the place of the value of generating assets or the stated maximum output of a wind turbine. Traditionally, taxation involved the provincial government assessing the value of generation assets associated with a project ($2-$4 per $100 of assets) and the municipality applying its mill rate that varies between jurisdictions (CanWEA, 2006). In addition to the mill rate, a standardized mill rate required new wind developers to pay the municipality C$5,500/MW/year based on total capacity and required existing developers to pay C$4,500/MW/year based on total capacity, with rates subject to increase each year (CanWEA, 2006). This provided a disincentive for developers of intermittent wind resources who were paying the highest start-up prices and property tax per MW in the province (CanWEA, 2006). However, the *Wind Turbine Facilities Municipal Taxation Act* (2006), designed for wind development, replaced this taxation regime. According to Demond, President of Pubnico Point Wind Farm Inc., the Act provides a very attractive steam of predictable tax revenue (CanWEA, 2006). Although an improvement to the original taxation regime, the Act creates a, "special tax per MW of nameplate capacity", defined as the stated maximum output of the wind turbine (SNSMR, 2007). The focus placed upon maximum turbine output acts as a disincentive for developers of intermittent renewable sources such as wind, as generation facilities do not reach maximum output consistently. As such, it is recommended that taxation instead be based upon actual production of a wind generation facility.

Recommendation 5: Consider increasing the depreciation rates of the current accelerated tax depreciation regime under Class 43.1 and Class 43.2.

Electrical Sector Goal Achieved: 'Increased Affordability' thorough a reduction in tax burden on intermittent resources.

Further increasing depreciation rates of the current accelerated tax depreciation regime under Schedule II to the Income Tax Regulations Class 43.1 and Class 43.2 is recommended, as it would offer greater incentive for wind development, given that much of the capital investment occurs at the project onset. Assets are normally depreciated at rates between 4 and 20 percent (Blommaert, 2007). However, Class 43.1 is applied to assets acquired before February 23, 2005, including renewable energy sources (i.e. wind, solar, and small hydro), and is characterized by a 30 percent depreciation rate (Energy Works, 2007). Since 2005, assets acquired on or after

February 23, 2005 and before 2012, are subject to depreciation rates of 50 percent under Class 43.2 (EnergyWorks, 2007).

Recommendation 6: Consider reinstating the NSPI 'green power' program following a re-evaluation of the rate applied to 'green power', given consideration for the current cost of fuel and the electricity produced using wind technologies.

Electrical Sector Goals Achieved: Increased 'Public Support' through offering NSPI consumers a choice in the origin of their electricity.

It is recommended that NSPI reinstate their 'green power' program, originally cancelled in 2006, offering consumers the option to purchase electricity from renewable sources at a premium price (Lipp *et al*., 2006). This program would provide consumers with the ability to take greater accountability for how the electricity they consume is produced and support renewable energy development in the province. The NSPI 'green power' program originally offered consumers a rate of four cents per kWh above the residential rate. According to Larry Hughes (2002), this rate cannot be justified as the cost per kWh of the two wind turbines used to generate the 'green power' compared favorably with NSPI's existing generation assets. Accordingly, the premium applied to 'green power' in this program must be re-evaluated in light of current fuel prices and the cost of electricity produced using wind technologies.

Recommendation 7: Continue to develop and implement federal (and provincial) incentive programs in support of renewable technology development.

Electrical Sector Goals Achieved: 'Increased Affordability' of development through the provision of incentives.

Currently the federal government offers several incentive programs that act to support wind development (Jacques Whitford, 2008):

- Technology Early Action Measures (TEAM): supports projects that are designed to develop technologies which mitigate GHG emissions;
- Atlantic Canada Opportunities Agency (ACOA) Business Development Program: offers access to capital in the form of interest-free, unsecured repayable contributions, focusing on small and medium sized enterprises;
- The Renewable Energy Technologies Program (RETP): funds R&D pre-commercialization, including testing and demonstration projects;
- Canadian Renewable and Conservation Expenses (CRCE): fully deductible expenditures associated with the start-up of renewable energy and energy conservation projects for which at least 50 percent of the capital costs of the projects would be described in Class 43.1;
- Class 43.1 and 43.2 (Canada Revenue Agency and Natural Resources Canada): capital cost allowance (CCA) rate of 30 to 50 percent for certain types of renewable energy and energy efficiency equipment.

It is recommended that programs offering incentives to renewable energy developers on the federal and provincial level continue to be sought and instigated.

Recommendation 8: Re-establish Federal government investment in the ecoEnergy for Renewable Power Program, discontinued in the Federal Budget 2009.

Electrical Sector Goals Achieved: 'Increased Affordability' of development through the provision of incentives.

The ecoEnergy for Renewable Power Program has been an important stimulus for wind energy development in Canada, providing C$0.01 per kWh of renewable energy generated (CanWEA, 2009). This program was discontinued in the 2009 Federal Budget, following recommendations from CanWEA that the government allocate C$200 million per year towards the program (Flanagan, 2008). Such a commitment would support an additional 8,000MW of renewable energy development and extend the program deadline to March 31, 2014 (Flanagan, 2008). Extension of the program would not only make Canada a more attractive destination for investment in wind technologies, it would also leverage over C$6 billion in new private sector investment and create approximately 8,000 new jobs (CanWEA, 2009; Flanagan, 2008). It is suggested that a portion of the C$1 billion pledged for the Green Infrastructure Fund in the 2009 Budget (DOF, 2009), be allocated to shovel ready wind energy projects that could create jobs in the short term.

Recommendation 9: Avoid implementing a provincial royalty on wind resources until the industry within Nova Scotia becomes stable and profitable.

Electrical Sector Goals Achieved: 'Increased Affordability' of development through ensuring competitiveness, flexibility, and profitability.

It is recommended that the provincial government avoid royalties associated with wind energy development, as discussed in the Energy Strategy (2009), until the sector becomes stable and profitable. Should royalties be considered beyond this point, the provincial government commits to maintaining competitiveness, flexibility, and profitability within the sector (NSDE, 2009). This is deemed critical to the viability of the industry.

Market Structure

Recommendation 10: Consider the creation of a 'green' regional market including Nova Scotia, New Brunswick, and Prince Edward Island, with the potential to extend to Quebec and New England.

Electrical Sector Goals Achieved: 'Grid Reliability and Stability' through utilizing regional balancing to enable Nova Scotia to achieve a greater percentage of it's electrical demand from intermittent wind resources.

In response to the barriers associated with the smaller, isolated nature of the market in Nova Scotia and the lack of competition, it is suggested that the creation of a 'green' regional marketplace be considered. This market would enable regional balancing to occur, using wind or other renewable energy sources, between Nova Scotia, New Brunswick, and Prince Edward Island ('Maritime Area'), and could extend to include Quebec and New England (Figure 3). The regional market would entail increased regional planning, development, and management of wind resources. When markets are extended regionally, it will help enable the import of competition (EAEA, 2008). This is important in smaller jurisdictions, like Nova Scotia, in which the need for consolidation limits the number of market players that can operate effectively (EAEA, 2008). A regional market would also

Figure 3. The regional gird (EAEA, 2008).

mitigate the intermittency barrier, as studies have shown that wider regions are the less volatile to wind variations (NBSO, 2008). In Nova Scotia, annual market demand is approximately 13 terawatt hours (TWh) (EAEA, 2008). Electricity demand in New Brunswick (includes Prince Edward Island and Northern Maine) is 17TWh, in Quebec it is 188TWh, and in New England it is 127TWh (EAEA, 2008). Within a regional market, investment in wind development would likely become more economical, as exports to jurisdictions with higher demand would become feasible and thus, greater profits attainable.

A regional market would involve regional co-ordination, collaboration, and co-operation when creating market rules. According to a New Brunswick System Operator Discussion Paper, such a market would require (NBSO, 2008):

- Strengthening of inter-ties, specifically the 1,000MW interface between New Brunswick and New England. Transmission upgrades could take the form of an additional 345 kilovolt (kV) alternating current (AC) transmission and/or high-voltage direct current (HVDC) transmission as it can provide quick response when balancing is required;
- A reduction in maximum capacity along interfaces to leave space for balancing wind energy in other provinces or states, thus, reducing transmission capacity for economic transactions;
- Consideration for new projects based upon their ability to regulate or correct for variations in wind generation;
- Greater coordination of renewable development policies in the Maritime Area;
- Creation of a Maritime Area wind forecasting system and control strategies;

- Greater co-ordination and communication between the Maritime Area and New England in light of sharing real-time and historical wind data, standardization of regulations and load following, and the creation of fair and consistent controls and processes to ensure reliable operation.

A major issue with this recommendation is the cost of system upgrades that would be involved. Currently, Nova Scotia shares an inter-tie with New Brunswick, capable of handling 350MW of imports and 300MW of exports (NSDE, 2009). New Brunswick shares an inter-tie enabling it to import 50MW and 1,1000MW of electricity, from New England and Quebec, respectively (NSDE, 2009). This inter-tie also provides New Brunswick with the ability to export 700MW to both New England and Quebec (NSDE, 2009). Strengthening the inter-ties between these jurisdictions would be critical should a regional marketplace be formed. Another issue identified is that of transmission and expansion costs – who will pay for upgrades to the system? Within the New England, the cost of these upgrades are “socialized”, or spread among all users of the regional transmission system through a regional uplift charge, should the parties be unable to agree upon who benefits from the upgrade (Cowart, 2002; MPUC, 2002).

Within the regional marketplace, the creation of a regional planning authority would be required as done in Denmark. In 1999, a revised executive order was released in Denmark, the “Wind Turbine Circular”, which made county authorities responsible for planning wind development (NRC, 2007). As such, local authorities provide all approvals (environmental, building, power production), are responsible for identifying suitable locations for wind power development (considering gird access and connection costs), enable developers to avoid lengthy bureaucratic approval procedures, and ensure that turbines are sited in coordination with other spatial planning considerations in the region (NRC, 2007). Under the guidance of a regional planning authority, Denmark met its original goal of 1,500MW of wind energy, as identified in the Energy 2000 plan, several years before the 2005 deadline (NRC, 2007). Also required within a regional market would be the collection of more accurate wind data to better predict wind variability and energy balancing requirements (NBSO, 2008).

A benefit associated with engaging in a regional marketplace and strengthening Nova Scotia's connection with neighbouring jurisdictions includes the export opportunities that will increase the profitability of the industry. The United States has the world's largest electricity market and a growing appetite for green power, with 30 American states now adopting RPS mechanisms (Flanagan, 2008). As such, the exchange of 'green' electricity will become increasingly important. Within a regional market, Nova Scotia would be linked to New England, which includes Massachusetts, Maine, New Hampshire, Vermont, Rhode Island and Connecticut. Each of these jurisdictions has developed some form of RPS:

- Massachusetts: An RPS established in 1997 as part of the *Utility Restructuring Act*. The Act requires four percent renewable generation by 2009, increasing by one percent each year between 2010 and 2014 (MTC, n.d.).
- Maine: In 1999, the Maines Public Utilities Commission adopted a renewable portfolio requirement, requiring that competitive electricity providers supply at least 30 percent of their total retail electric sales from renewable sources. In 2006, the state adopted a new RPS goal to increase new renewable energy capacity by 10 percent by 2017. This target became a mandatory standard in 2007 (DSIRE, 2009a).
- New Hampshire: Enacted in 2007, the RPS requires electricity providers to acquire renewable energy certificates equivalent to 23.8 percent of retail

electricity sold to end-use customers by 2025. Of the 23.8 percent, 16.3 percent must be derived from sources installed after January 1, 2006, while the remainder can be derived from existing sources (DSIRE, 2009b).

- Vermont: In 2005, a RPS was enacted, requiring renewable generation to equal incremental load growth between 2005 and 2012. For example if the state experiences seven percent load growth, utilities must obtain seven percent of their electricity from eligible renewable sources by 2012 (Pew, n.d.).
- Rhode Island: A RES, enacted in 2004, requires that the state's retail electricity providers supply 16 percent of their retail electricity sales from renewable resources by the end of 2019 (DSIRE, 2009c).
- Connecticut: The RPS was established in 1998, requiring that each electric supplier and each electric distribution company wholesale supplier obtain at least 23 percent of its retail load using renewable energy by January 1, 2020 (DSIRE, 2009d).

Setting up a 'green' regional market for exchange of electricity from wind and other renewable energy sources seems appropriate should we wish to engage in viable trade with the US, as regulations surrounding green energy are becoming more stringent. Furthermore, consider the Regional Greenhouse Gas Initiative (RGGI) that will come into effect this year, 2009 (EAEA, 2008). RGGI is a cap and trade system that limits the CO_2 emissions to recent historic levels during the period of 2009-2014 and requires a 10 percent reduction in CO_2 emissions towards 2018 (EAEA, 2008). In Nova Scotia, our exports must comply with the requirements of other jurisdictions should we wish to remain competitive.

Overall, the creation of a ‘green’ regional market will enable the import of competition, a difficult achievement in smaller jurisdictions, like Nova Scotia, in which the need for consolidation limits the number of market players that can operate effectively (EAEA, 2008). Wider regions are also less volatile to wind variations, thus, mitigating the intermittency barrier (NBSO, 2008). Should Nova Scotia begin to realize its full wind energy potential through deriving a greater percentage of electricity demand from the intermittent wind resource, regional balancing with neighbouring markets could act to reduce the risks associated with balancing supply and demand. A study by EAEA (2008) indicated that wind development in a regional context could yield 2,000 to 2, 500MW of wind generation in Nova Scotia by 2025. It is suggested that the integration of such large amounts of wind power within Nova Scotia is not feasible without greater cooperation between neighbouring markets and systems, regional balancing and market rules, utilization of interconnectors, and the establishment of new transmission lines (EAEA, 2008). As such, a regional marketplace would enable Nova Scotia to realize its full wind potential, may be associated with economic benefits (i.e. job creation and turbine fabrication facilities), would ensure greater security of supply through an emphasis on renewable wind energy, help the province meet its goals under the Climate Change Action Plan, and reduce negative externalities associated with fossil fuel combustion (i.e. reduction in health care costs).

It is cautioned here that the export opportunities and associated profits will likely attract larger scale wind developers. Mechanisms must be in place to ensure that smaller scale developments retain a percentage of the market share, including a FIT for smaller scale generation within the current RFP process or changes to the current Net Metering program (Chapter 5 ‘Recommendations 1 and 2’). Smaller scale wind is critical to foster public support, conservation, and accountability within the population. Furthermore, should a regional marketplace be created, electricity exported between jurisdictions for regional balancing must be generated by wind and/or other renewable technologies, at the exclusion of conventional fuel sources. Expansion of the marketplace must be done for the purposes of increasing the percentage of electricity in Nova Scotia that can be derived from wind and must involve decreased use of coal, natural gas, and other petroleum products. The provincial Climate Change Action Plan (NSDEnv, 2009a) indicates that the Department of Energy will be leading studies beginning in 2009 to examine regional electricity integration, "Green the Grid Initiative". This is a positive step towards the realization of an effective 'green' regional marketplace.

Recommendation 11: Focus on distributed generation across Nova Scotia involving economically viable wind developments that take advantage of economies of scale (>1-2MW).

Electrical Sector Goals Achieved: 'Grid Reliability and Stability' through strengthening weaker sections of the gird, 'Increased Affordability' through reductions in grid upgrades required to increase the penetration of wind technologies

To mitigate the cost of transmission upgrades required to increase competition across the marketplace, it is recommended that focus be placed on distributed generation. This approach would limit the electricity that is required to flow long distances through the transmission system and the load placed upon the grid as a result of large quantities of electrons entering at one point. Distributed generation, besides mitigating system volatility, is said to control price increases and reduce negative externalities in the production and consumption of energy (EEEI, 2006). If the goal is to create a viable marketplace, it is stressed that turbine developments close to the grid exploit economies of scale (>1-2MW) (Respondent fourteen). Within Net Metering programs in other jurisdictions, best practices suggest a project size limit of at least 2MW to take advantage of economies of scale (Lipp, 2007). Small wind turbines erected for individual use when the developer has the opportunity to connect to the grid and generate sufficient amounts of electricity to supply many households, becomes material intense, costly, and provides less CO_2 offset (Respondent fourteen). However, the developers ability to erect smaller scale turbines to support electricity demands on a single property is an option that remains superior to the use of conventional fossil fuels, promotes public support (reduced NIMBYism), encourages conservation and energy accountability, and sends a signal to the utility that consumer preferences have changed. An alternative to the use of turbines designed to power an individual property would be the creation of wind co-operatives involving community investment within projects able to supply the larger community with renewable power. This type of community buy-in develops of sense of pride and ownership in the wind development projects and may act to mitigate the effects of NIMBYism.

Utility Restructuring

Recommendation 12: Cautiously consider the costs and benefits associated with deregulation of the electricity sector (separation of transmission and distribution from the generation and retail aspects of the electricity market).

Electrical Sector Goals Achieved (If Successful): ‘Grid Access’, ‘A Right to Sell’, a ‘Competitive/Fair Price’, ‘Grid Reliability and Stability’.

Barriers discussed in Chapter 4 address the lack of competition (grid access and a right to sell) within the electricity market and the lack of investment in upgrades to the current infrastructure. NSPI is a vertically integrated monopoly in Nova Scotia, owning and/or operating 97 percent of generation, 99 percent of transmission and 95 percent distribution in the province

(Lipp *et al.,* 2006, Hatch, 2008; Tu, 2005). Given the current circumstances, it is recommended that deregulation be cautiously considered as a potential solution capable of mitigating these barriers, through the separation of transmission and distribution from the generation and retail aspects of the electrical market. The arguments for and against utility unbundling with respect to increasing competition and investment in infrastructure will be discussed in this section. Additionally, Nova Scotia's position will be examined with respect to the conditions deemed favorable for deregulation.

Deregulation, or unbundling, involves a market design that transforms a market driven by regulated, integrated utilities into one that relies upon competition (Woo *et al*., 2004). This reform typically separates a formerly integrated electric utility into unregulated generation companies, a regulated transmission company, and one or more regulated local distribution companies (Woo *et al*., 2004). Customers in a reformed electricity market can choose to buy electricity from wholesale generation markets (spot price pool and bi-lateral markets) or distribution companies and retailers (Woo *et al*., 2004). A transmission company owns and operates the grid and offers open and comparable access to all market participants (Woo *et al*., 2004). Alternatively, an Independent System Operator (ISO) leases the transmission facilities from the owner and is responsible for reliable grid operation through providing efficient dispatch and congestion management, provision of open and comparable access, and transmission tariff design administration (Woo *et al*., 2004). There are many transmission ownership models in existence; however, the ISO model may be a good approach for transmission unbundling in Nova Scotia, as it was noted to be cheaper within an already liberalized system like Nova Scotia's electrical market (Pollitt, 2008). The ISO can also operate at the regional market level, an asset should 'Recommendation 10' be implemented. It should also be noted, that this approach would be compatible with New England ISO (ISO-NE).

Jurisdictions that have experienced the most successful electricity reforms, given consideration for the extent of competition in generation and retail and the sophistication and effectiveness of regulations, include: New Zealand, Victoria and South Australia, Chile, Argentina, the Nordic Countries, England and Wales, New York, Texas, and the Pennsylvanian New Jersey Maryland market (PJM) (Pollitt, 2008). An ISO and independent generation characterized all successful jurisdictions and problems existed where transmission was not fully separated from generation (Pollitt, 2008). Within all successful cases, the separation of transmission and generation encouraged greater competition in generation, kept the cost of transmission down, and provided little evidence that investment in transmission was adversely impacted (Pollitt, 2008).

However, post-reform experience in other jurisdictions has indicated a failure to deliver reliable services at reasonable and stable rates (Woo *et al*., 2004). Although it is argued that the competition and privatization associated with electricity deregulation can improve a sectors cost performance (reducing the number of employees and non-fuel expense per MW of capacity), restructuring can also increase the cost of capital, leading to a net increase in the cost of generation as the financing cost will likely trump the operations and maintenance savings (Woo *et al*., 2004). An econometric analysis of price data from 19 OECD countries found that, "the unbundling of generation and the introduction of a wholesale sport market did not necessarily lower the price and may possibly have resulted in a higher price" (Woo *et al*., 2004). Electricity spot prices are also noted to be volatile within a deregulated system. For example, in Ontario when the market opened in May 2002, the wholesale average price was C$30/MWh (Woo *et al*., 2004). By August is had risen to C$69/MWh and by September prices were at C$83/MWh (Woo *et al*., 2004). However, contradictory to this evidence, a study conducted by Copenhagen Economics, examined electricity and gas prices in the European Union (EU) between 1990 and 2003 and found that higher levels of unbundling lead to lower electricity prices (Pollitt, 2008).

There is also conflicting evidence surrounding the impact of deregulation on infrastructure investment. Prior to deregulation in Chile, the integrated nature of generation and transmission delayed investment in infrastructure, as utilities did not want to benefit rivals (Pollitt, 2008). Where problems have existed with lack of investment in infrastructure, as seen in the US, it has been attributed by some to be an unwillingness of regulators to allow new investments to be included in regulated rates (Pollitt, 2008). For example, a shortcoming in the Nordic Power Pool market, where the capacity between Norway and Sweden has fallen short many times, is a result of the lack of clearly defined rules prescribing when network expansions are to be built by grid companies and how they will be financed (Woo *et al*., 2004). Alternatively, disconnection of generation and transmission is said to eliminate the economies of joint planning and coordination, decentralize investment, shifting the risk from consumers to investors, and create uncertainty surrounding returns (Woo *et al*., 2004). This results in increased cost for capital and decreased investment in generation that could extend to transmission and distribution investment. According to the US National Commission on Energy Policy (2003): "Electric-industry restructuring has derailed. The massive black-out in 2003…adds urgency to the effort to find solutions…indeed, investment in all categories of electricity infrastructure is down significantly" (pg.3).

Denmark will be used as an example of successful utility unbundling, as many physical characteristics of the electricity systems in the Maritimes and Denmark resemble each other:

including similar electricity consumption, physical size, and neighbouring markets (EAEA, 2008). One of the Danish governments most decisive roles was the creation of a framework to allow effective competition in the market place, through breaking-down monopolies that existed in the traditional vertically integrated utilities and separating transmission network activities from commercial activities through true ownership bundling (EAEA, 2008). This was done with the belief that networks and system operation are natural monopolies that must be subject to regulation, while generation and retail should be subject to competition (EAEA, 2008). Denmark now has an Independent Transmission System Operator (ITSO), with a responsibility for maintaining the security of supply of electricity and gas, monitoring and developing energy markets, developing the Danish electricity and gas transmission infrastructure, and comprehensive planning taking into account future transmission capacity requirements and security of supply (EAEA, 2008). This ITSO also plays an important role in ensuring that there is transparency in the market place through ensuring that competitive market players collect and publish fundamental market data and statistics (EAEA, 2008). Such transparency is a proven instrument leading to continuous development of a more effective market (EAEA, 2008). Denmark is noted to have a highly successful model involving competition, with continuing public ownership of many assets (Pollitt, 2008).

The conditions considered favorable for jurisdictions considering deregulation include interconnection with neighbouring markets, local fuel availability, easy market entry by Independent Power Producers (IPPs), and adequate capacity prior to reform (Woo *et al*., 2004). Looking more closely at the electricity market within Nova Scotia with respect to these conditions, the following conclusions are reached:

- Currently in Nova Scotia, interconnection with neighbouring New Brunswick is weak, with 350MW and 300MW, import and export capacity, respectively (NSDE, 2009). It should be noted that interconnection could be strengthened, although the cost associated with such upgrades is unknown.
- Regarding local fuel availability, in the 1980s and 1990s, coal was purchased from Cape Breton by NSPI for electricity generation (Hughes, 2007). This program ended in 2001 and concerns over reinstating it surround the high sulphur content of the coal, a disadvantage in a market place becoming increasingly conscious of emissions (Hughes, 2007).
- Market entry by IPPs currently involves competitive procurement under the RFP process. This process leads developers to the queue, where they wait in chronological order, based upon the bid submission date, for grid access (UARB, 2008b). Prior to connecting to the gird, NSPI must carryout power and infrastructure related studies, which determine the requirements and cost for each project (UARB, 2008b). Additionally, developers must also meet all other requirements of the Open Access Transmission Tariff (OATT) and underlying Generation Interconnection Procedures (GIP) (UARB, 2008b). Many interview respondents referred to this process as administratively complex. It is acknowledged that ease of gird access is a barrier applicable to the current system.
- Finally, NSPI appears to have adequate capacity to meet current demand within Nova Scotia.

Overall, Nova Scotia does not satisfy the majority of conditions that would suggest that it is an ideal candidate for deregulation. Furthermore, it was noted that it is ideal to integrate competition within a marketplace prior to unbundling, as there are fixed costs associated with restructuring assets and the establishment of regulatory structures (Pollitt, 2008). This would require Nova Scotia to invest first within the introduction of greater competition into the market place. Additionally, it was noted that unbundling is cheaper when ownership structure is less capital intensive to change, as in the case when there is public ownership of the utility (Pollitt, 2008). This may pose another barrier to Nova Scotia's attempt at deregulation, as NPSI is privately owned. Finally, the size of the market intended for re-structuring is also important (Pollitt, 2008). In small markets, the scope of competition may be limited and the managerial expertise scare; thus, the benefits of unbundling will likely be small in relation to the cost (Pollitt, 2008). A small power system was defined as 1,000MW, although Guatemala was able to create a competitive wholesale market with a capacity of 1,875MW (Pollitt, 2008). Currently, the Nova Scotian market sits at 61MW of wind capacity and had a total winter peak load capacity in 2007 of 2,257MW (Hatch, 2008).

On a more philosophical level, it could be argued that access to electricity is a fundamental right that should be provided by government to those in society. With this in mind, it would follow that transmission and distribution systems should be owned by the community or a body not looking to make profit. If one agrees that electricity is a fundamental right, it seems contradictory to have the provision of this right tied to a utility that has an interest in both generating and selling electricity for a profit, as is the case in Nova Scotia.

Overall, there are many costs, benefits, and uncertainties associated with deregulation. Should deregulation be considered in Nova Scotia, extreme caution must be applied, given the large quantity of conflicting evidence and the reality that Nova Scotia does not currently satisfy the following conditions favorable for deregulation: interconnection with neighbouring markets, local fuel availability, and easy market entry by IPPs. It is recommended that careful cost-benefit analysis be conducted to estimate the extent of the costs and benefits associated with unbundling in Nova Scotia before it is seriously considered.

Research and Development Tools

Recommendation 13: Investment channeled towards the development of new technologies for modeling/mapping wind resources.

Electrical Sector Goals Achieved: 'Increased Affordability' and 'Increased Efficiency' of wind data collection.

It is recommended that investment continue to be channeled towards the development of new technologies for modeling wind resources that demonstrate repeatability, accuracy, and reproducibility. The Wind Atlas project undertaken by the Nova Scotia Department of Energy in partnership with the K.C. Irving Chair in Sustainable Development

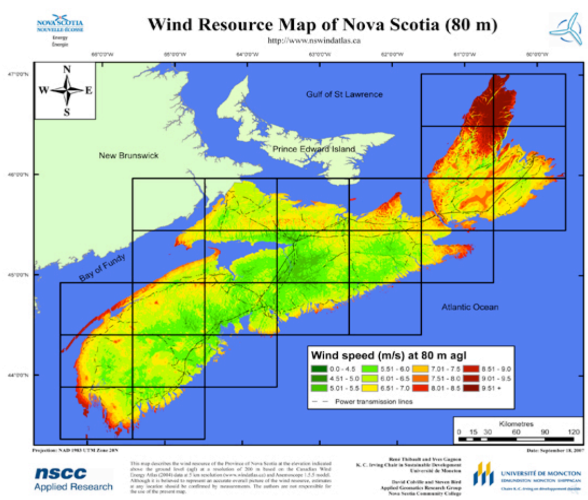

Figure 4. Nova Scotia wind atlas (NSDE, 2008c).

at the Université de Moncton and the Applied Geomatics Research Group at the Nova Scotia Community College provides the most accurate map of wind resources in the province, with a resolution of 20 metres (Figure 4) (Jacques Whitford, 2008). However, many other factors relevant to wind generation must be considered beyond accurate analysis of the wind resources, and include, but are not limited to, access to land, municipal bylaws, community relationships, and the ecological sensitivity of the area. This will enable the development of a comprehensive, holistic tool that will simplify the turbine siting process. Additionally, research should continue to focus upon improving current wind data collection technologies, including the popular anemometer, or recently developed technologies, including satellite imagery. Currently, erecting a wind data collection tower to obtain project specific data can cost between C$15,000 and C$75,000. Alternatively, advancing satellite imagery technologies can cost as little as US$20,000 for an area of 26 kilometers (km) by 26 km (Respondent three). Accordingly, advancing technologies can increase accuracy, repeatability, and reproducibility of the wind data collected, while ideally reducing the cost of attaining wind data.

Recommendation 14: Investment channeled towards the development of new technologies for economic storage of excess electricity generated from wind.

Electrical Sector Goals Achieved: 'Increased Efficiency' of wind electricity storage, 'Grid Reliability and Stability' through improved ability to match supply and demand.

It is recommended that investment continue to be channeled towards the development of economic means for storage of excess electricity generated from wind. This would mitigate the barrier associated with intermittency. For example, converting wind electricity into thermal energy to be stored in thermal storage heaters and used for home heating (Hughes, 2007). Hydroelectricity has been suggested as a solution, although the use of hydroelectric storage of excess wind electricity has generated heated community opposition and seasonal precipitation variations in filling hydroelectricity reservoirs would likely prove burdensome (Hughes, 2007). Smart gird technologies may be considered as they offer electricity consumers and the utility real-time energy monitoring data, creating the opportunity for greater efficiency, reductions in cost through using power during off-peak hours, and the ability to balance renewable supply and demand (Tucker, 2009; Claburn, 2009). However, many concerns surround the use of the smart grid, including security issues, the need for gird upgrades to avoid line losses, and the underlying societal patterns of energy consumption that are difficult to change (i.e. increased residential energy use before and after regular working hours between 9am and 5pm) (Tucker, 2009). Upgrading to a 765 kV direct current (DC) system is recommended (Tucker, 2009). Currently, the transmission network in Nova Scotia consists of 69kV, 138kV, 230kV, and 345kV lines (Hatch, 2008). The cost associated with upgrading the current system is currently unknown, although it can be reasonably foreseen to be capital intensive. Furthermore, although the smart gird is associated with shifts in electrical demand to off-peak periods and may result in a decrease in the price of electricity, energy consumption, if left unchecked, could increase and compromise GHG reduction goals (Tucker, 2009; Claburn, 2009). In the 2009 Energy Strategy, the province committed to supporting smart meter pilot projects (NSDE, 2009). This is a positive step; however, careful cost-benefit analysis should be conducted prior to the implementation of such technologies in Nova Scotia.

Public Education Tools

Recommendation 15: Greater government investment channeled towards public education focusing on the technical and policy requirements of a renewable energy regime, the benefits of renewable resource development, the science behind advancing wind technologies, and the significance of conservation and efficiency.

Electrical Sector Goals Achieved: ‘Public Support’, ‘Conservation and Efficiency’, and ‘Skills Development and Employment’.

It is recommended that government investment occur at every level within the renewable energy sector (Respondent ten). From training a skilled work force dedicated to the development and maintenance of renewable technologies and policy, to creating and instigating public outreach programs addressing the benefits of and science behind advancing wind technologies. This would be done with the hope of alleviating some of the NIMBYism associated with wind development and developing the expertise required for sustainable expansion of the industry. Public outreach and education programs are also expected to reduce the 'real vs. perceived' impacts of wind development and the fears associated with a lack of understanding surrounding the technology and its impacts upon humans and the surrounding environment. Public outreach and education programs should also focus on the significance of conservation[7] and efficiency[8]. This will ensure that a transition to wind generation, that may involve a short-term increase in the amount of electricity available through the addition of more kWhs, is not coupled with increased demand placing strain on electricity infrastructure and fostering unsustainable energy use.

Intermittency and Coincidence

Recommendation 16: Focus on the development of economical storage options for electrical energy and demand-side management options.

Electrical Sector Goals Achieved: 'Grid Reliability and Stability' through matching supply and demand.

Intermittency and coincidence were identified as complimentary barriers within the literature review. As a result of intermittency, the output from a wind turbine may or may not coincide with demand (Hughes, 2007). This results in the need for special services when the wind resources fall short (top-up) and when the wind resource output exceeds demand (spill) (Hughes, 2007). These demand side management options are offered by the utility for a premium

[7] The consumer's use of utility services decline, resulting in a decrease in energy demand (Hughes, 2007).
[8] The consumer's use of utility services remains unchanged or increases, but the technology associated with the service improves, resulting in a decrease in energy demand (Hughes, 2007).

rate and may mitigate the variability of the intermittent wind resource and reduce or delay the need for infrastructure investment (NRCan, 1994; Hughes, 2007). For example, demand side management options include using “load shifting” to reduce the demand at peak times by offering preferential time of use rates that favor electricity use when the demand is traditionally lighter; “load reduction”, involving the reduction of user demand through promoting more efficient appliances; and “peak-clipping”, involving providing preferential rates to clients with an interruptible load, allowing the utility to reduce the demand at during peak periods and shift it to another time (NRCan, 1994). In addition, the utility must also look towards replacing insecure sources of energy and implementing policies that reduce the consumption of electricity (Hughes, 2008b).

See Chapter 5 ‘Research and Development Tools’ ‘Recommendation 14’ for discussion surrounding economical storage solutions. Such solutions would act to mitigate intermittency and coincidence, thus, enabling supply and demand to be balanced more effectively.

Chapter 6

Conclusion

Introduction

This qualitative study has identified a number of barriers, as perceived by previous researchers and stakeholders in the electrical power generation sector, preventing greater penetration of wind energy in Nova Scotia. In light of these barriers, recommendations have been presented that would enable the realization of the ‘electrical sector goals’: grid access, a right to sell, a competitive/fair price for a unit of electricity, increased affordability of development, greater public support, and skill development and employment. Achieving these ‘electrical sector goals’ will assist in attracting more wind energy to the electrical generation sector and enable Nova Scotia to achieve greater energy security, environmental protection, and economic stability and development, the three major goals of renewable energy policy.

Summary of Barriers and Recommendations

Many barriers exist, preventing the greater penetration of wind and other renewable technologies in the province in order meet the ‘electrical sector goals’ and targets. The barriers identified in this study through extensive literature review and consultation with stakeholders in the electrical generation sector broadly include: policy, social perception, technical constraints, cost, transparency, market structure, government support, research and development, intermittency, and turbine impacts. Recommendations capable of overcoming or mitigating these barriers in order to achieve the desired ‘electrical sector goals’ were made with consideration for the ‘portfolio of tools’ available. Such recommendations broadly include:

1. Regulatory Tools

- Recommendation 1: Permanently integrate a feed-in-tariff (FIT) for smaller scale wind generation within the current request for proposal (RFP) process. Alternatively, and less ideally, avoided cost purchasing could be used in the place of a fixed price for a unit of electricity.

- Recommendation 2: Continue to improve the current net metering program with consideration for the best practices from other jurisdictions.

- Recommendation 3: Support the market price on carbon under the new federal "Regulatory Framework for Industrial Greenhouse Gas Emitters" and the provincial Greenhouse Gas (GHG) caps on NSPI in light of leveling the 'playing field' between conventional fuel sources and renewable generation.

2. Fiscal Tools

- Recommendation 4: Consider restructuring the property tax regime to base taxation on actual production from a wind generation facility, as opposed to the stated maximum output of a turbine.

- Recommendation 5: Consider increasing the depreciation rates of the current accelerated tax depreciation regime under Class 43.1 and Class 43.2.

- Recommendation 6: Consider reinstating the Nova Scotia Power Incorporated 'green power' program following a re-evaluation of the rate applied to 'green power', given consideration for the current cost of fuel and the electricity produced using wind technologies.

- Recommendation 7: Continue to develop and implement federal (and provincial) incentive programs in support of renewable technology development.

- Recommendation 8: Re-establish Federal government investment in the ecoEnergy for Renewable Power Program, discontinued in the Federal Budget 2009.

- Recommendation 9: Avoid implementing a provincial royalty on wind resources until the industry within Nova Scotia becomes stable and profitable.

3. Market Structure

- Recommendation 10: Consider the creation of a 'green' regional market including Nova Scotia, New Brunswick, and Prince Edward Island, with the potential to extend to Quebec and New England.

- Recommendation 11: Focus on distributed generation across Nova Scotia involving economically viable wind developments that take advantage of economies of scale (>1-2MW).

4. Utility Restructuring

- Recommendation 12: Cautiously consider the costs and benefits associated with deregulation of the electricity sector (separation of transmission and distribution from the generation and retail aspects of the electricity market).

5. Research and Development Tools

- Recommendation 13: Investment channeled towards the development of new technologies for modeling/mapping wind resources.

- Recommendation 14: Investment channeled towards the development of new technologies for economic storage of excess electricity generated from wind.

6. Public Education Tools

- Recommendation 15: Greater government investment channeled towards public education focusing on the technical and policy requirements of a renewable energy regime, the benefits of renewable resource development, the science behind advancing wind technologies, and the significance of conservation and efficiency.

7. Intermittency and Coincidence

- Recommendation 16: Focus on demand-side management and the development of economical storage options for electrical energy.

Next Steps

Given the broad nature of this study, recommendations require considerably more market specific research prior to implementation on a practical scale in Nova Scotia. Furthermore, time constraints limited the extent to which each barrier could be addressed. As such, further research should address the following areas:

- Determination of the appropriate maximum project size for use in the feed-in-tariff (FIT) program offered for smaller scale wind development in the current request for proposal (RFP) process and/or the maximum Net Metering project size that could be utilized to attract smaller scale operations to the grid (Chapter 5 'Recommendations 1 and 2'). Consideration should be given for market specific conditions including, but not limited to, electricity demand, the electrical grid capacity, and the availability of turbine manufactures, retailers, and expertise.

- Determination of an appropriate price per unit of electricity under a FIT program, given valuation of both the negative and positive externalities associated with electrical consumption using conventional fuel sources (coal, natural gas, and petroleum products) and wind and other renewable sources. This valuation should also consider the life-cycle cost of conventional and renewable energy. It is also noted here that the FIT will vary based upon location, maturity of the technology, resource availability, and the scale of the project (Lipp, 2008).

- In-depth analysis of the costs and benefits associated with deregulation within the electrical generation sector in Nova Scotia should be undertaken, in light of Chapter 5 'Recommendation 12'. Consideration should be given for market specific conditions within Nova Scotia and neighbouring jurisdictions and focus should be placed upon assessing the value that can be derived from separating transmission and distribution from generation and retail.

• Analysis of the feasibility of creating a 'green' regional market, including Nova Scotia, New Brunswick, and Prince Edward Island, with the potential to extend to Quebec and New England. This analysis should expand upon the benefits and costs that were discussed in Chapter 5 'Recommendation 10'. Consideration must also be given for the cost of electrical infrastructure upgrades and the need to conform to market practices and policies in neighbouring jurisdictions.

• Determination of an appropriate price for 'green power' under the reinstated NSPI 'green power' program. Consideration must be given to the generation costs associated with both conventional fuels and advancing wind technologies.

• Evaluation of the costs and technical implications associated with upgrading the current electrical infrastructure in Nova Scotia to move beyond the 2013 Renewable Energy Standard (RES), associated with an estimated 581 megawatts (MW) of wind electricity on the grid. Such an evaluation should be done with consideration for balancing a 'green' electrical load on a regional scale, acknowledging the need for inter-tie upgrades.

•Determination of the implications on the current electrical market dynamic should the Electricity Governance Committee (EMGC) Recommendation 51 be implemented, stating that, "any seller offering electricity from renewable resourced using facilities constructed in Nova Scotia after 2001 be able to sell directly to electricity consumers" (Government of Nova Scotia, n.d.).

- Further time and capital investment towards development of new technologies for wind resource modeling/mapping and economic electricity storage options.

Final Thoughts

As this study progressed, the complexity of the subject matter became increasingly evident. The barriers uncovered, each associated with an intricate aspect of the electrical power generation sector, were characterized by complex interrelationships. As such, attempts to mitigate one barrier must be coupled with consideration for others. For example, a recommendation to successfully overcome a barrier associated with the virtual monopoly held by NSPI, controlling the majority of distribution, transmission, generation, and retail – utility deregulation – must consider public education programs to ensure stakeholder engagement, research and development to understand technical implications of changes to the grid structure, market structure considerations including ownership, and many more. Recommendations for changes in the current electrical power generation sector must be holistic, incorporating a broad 'portfolio of tools' to address the barriers.

Achieving the three major renewable energy policy goals in today's electrical market – energy security, environmental protection, and economic stability and development - will require careful resourcing, leadership, and cooperation across stakeholder groups. The government will be responsible for facilitating this process. With an appropriate 'portfolio of tools' in combination with the support of stakeholders who are both passionate about and committed to achieving the three major renewable energy policy goals, an effective wind energy regime in Nova Scotia can be realized. The conversations held with stakeholders over the course of this study have proved that there is a passionate group of individuals who are committed to furthering the penetration of wind and other renewable energy sources within the electrical power generation sector in Nova Scotia and beyond. This demonstration of passion and commitment gives me great hope for the future of wind and other renewable technologies in Nova Scotia.

It is hoped that the research findings will contribute to the current literature on this topic and provide insight for those making critical policy decisions regarding the direction Nova Scotia will move with respect to energy use and management. It is my personal goal to have a role in the creation of solutions that enable sustainable and effective energy development in Nova Scotia, Canada, and beyond.

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Appendix A. Interview Respondents

Number of Individuals	Stakeholder Category
1	Small Scale Wind Developer (<300kW)
1	Medium Scale Wind Developer (300kW-2MW)
3	Large Scale Wind Developer (>2MW)
1	Wind Power Contractor
1	Municipal Utilities
2	Regulator
2	Environmental Non-Governmental Organization (ENGOs)
1	Wind Organizations
1	Wind Turbine Retailers
1	Industrial Power Users
1	Academia
2	Special Interest

Appendix B. Interview Guidelines

Wind energy development in Nova Scotia's electrical power generation sector: The role of policy mechanisms in the development of an effective wind energy regime

Interview Guidelines

Interim Goal: To speak with individuals involved within and knowledgeable about the electrical power generation sector and the development of wind technologies in Nova Scotia. Interview respondents will identify their perspective surrounding the barriers preventing greater wind development in the province and solutions to overcome these barriers.

Ultimate Goal: To present recommendations capable of overcoming or mitigating the barriers preventing greater development of wind technologies within the electrical power generation sector of Nova Scotia.

Name/Title:
Organization (if applicable):
Phone:
E-Mail:

The following five questions will guide us through the discussion. Should you have additional comments that you wish to express, feel free to do so.

You are reminded that you have the option to withhold confidential information during the discussion and to have elements of the discussion remain unrecorded. The discussion will be reflected within the final thesis document in a manner aligned with the concerns you express for anonymity and confidentiality.

1. What in your opinion and experience are the barriers preventing increased development of wind technologies within Nova Scotia?

2. Why do you consider the items above to be barriers (i.e. based upon what knowledge or experience)?

3. What changes would you recommend to overcome the barriers listed above?

4. How would the implementation of the changes you suggest above benefit you?

5. Are you aware of additional sources/contacts able to provide further insight?
    a. Environmental Non-Governmental Organizations (ENGOs)
    b. Residential power users
    c. Small business power users
    d. Industrial power users
    e. Wind technology retailers
    f. Regulators
    g. Wind power contractors
    h. Small scale wind developers (<300kW)
    i. Medium scale wind developers (300kW-2MW)
    j. Large scale wind developers (>2MW)
    k. Wind organizations
    l. Academia
    m. Municipal utilities
    n. Special interest

Thank you – Your time and consideration are greatly appreciated.

Please contact Alison should you have further questions or concerns.

Appendix C. Ethics Approval

November 24, 2008

Dear Ms. Koper;

I am pleased to inform you that your project titled **Wind energy development in Nova Scotia's electrical power generation sector: The development of an effective wind energy regime** has been accepted by the Environmental Programs Ethics Review Committee. Please inform us if you make any significant changes to your research program.

Sincerely,

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