The deployment of wind turbines: Factors which create accepting attitudes in local communities

By

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Abstract

Controversies surrounding the deployment of wind turbines: A research paper outlining factors which create accepting attitudes towards the development of wind turbines in local communities

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Wind turbines have been a popular choice for renewable energy since the recognition of the environmental and economic threats that have been posed by climate change in the early 20th century (Merkley, 2013). Wind turbines transfer the wind's kinetic energy into mechanical energy. The mechanical energy is then converted into electrical energy, and is transferred to a power grid. Due to the structural design, wind turbines are only efficient in regions of high wind strengths and are primarily deployed in large clear landscapes. Many European countries have displayed a moderate to strong public support for the implementation of wind turbines in their landscapes. Despite the high level of support for this type of technology in principle, many wind turbine development projects in many countries around Europe have been delayed or rejected due to local opposition. Many individuals are concerned with the potential health, environmental, and aesthetic impacts. Local citizens, developing companies and empowered political figures, all have their own understandings of the effects of the existing, as well as the future developments of wind turbines in their countries. The purpose of this paper is to examine what factors create accepting attitudes towards the development of wind turbines in local communities in France and Germany. These factors will then be used to assess a Canadian case to suggest that similar factors are influential in the Canadian context.

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Terms

BPW - Brookfield Power Wind

dB (A) – A-weighted decibel

EMI - Electromagnetic interferences

EU- European Union

GCWEP - Gosfield-Comber Wind Energy Project

GHG - anthropogenic greenhouse gas

Hz – hertz

IUSSC - Innovation, Universities, Science and Skills Committee

kV - kilovolt

LFN – Low Frequency Noise

LRPP – Large Renewable Procurement Program

LTEP - Long-Term Energy Plan

m – Meters

m/s – Meters per second

MW - Megawatts

NIMBY - Not-In-My-Backyard

PIMBY – Please-In-My-Backyard

PPS - Provincial Policy Statement

SPL – Sound Pressure Levels

SWEI - Superior Wind Energy Incorporated

VVA – Vertical visual angle

Table of Contents

Introduction

The Intergovernmental Panel on Climate Change created an uproar in early 2007 when they published a report which stated that global warming and all associated climate change is now “unequivocal” (IPCC, 2007). The IPCC pointed out the increasing levels of anthropogenic greenhouse gas (GHG) over the past 50 years. Due to the worldwide acceptance of climate change as a danger to both the environmental ecosystems and world economy, actions are being taken worldwide to stabilise global emissions of anthropogenic GHGs. One sector receiving attention is electricity generation and supply. More than one third of total greenhouse gas emissions from the electricity generation sector is produced in Europe (Prime et al., 2009), and overall the European Union (EU) ranks as the world’s third largest greenhouse gas polluter (CBC News, 2015). Due to this fact alone the energy sector in Europe is a key to decreasing global emissions.

In 2007, the EU outlined many policies for expanding domestic renewable electricity generating capacities within the 28-country bloc (CBC News, 2015). The EU stated that 30% of electricity should be obtained from renewable sources by 2020 (CBC News, 2015). In 2008, renewable energy technologies (RETs) accounted for only 5.5% of electricity generated in European countries meaning that a five-fold increase in renewable generating capacity would need to occur over the next decade (BERR, 2008) The discrepancy of RET deployment within the EU has been surprising since there seems to be a relatively high support for renewable energy initiatives (83-85%) based on surveys (BERR, 2008), but when it comes to the actual placement of these RETs within communities there often seems to be hesitation. Although many other forms of RETs such as tidal stream, ocean current and wave energy extraction require much further investment and testing to increase their viability, the Innovation, Universities, Science and Skills Committee (IUSSC) (2008) has published a report stating that mature renewable technologies, such as wind turbines are more than capable of reaching the EU target of renewable energy if placed in sufficient numbers. Regardless of this statement RETs are still very questionable and the future deployment of these RETs is likely to be influenced by a number of technical, social and economic factors.

Renewable power in Ontario, Canada is also a priority policy goal stated in the Provincial Policy Statement (PPS) and the Long-Term Energy Plan (LTEP) (CANWEA, 2015). Since the increase of GHGs the integration of renewable power has been increasing year by year. As of today Ontario is Canada’s leader in clean wind energy with a total installed capacity of 4361 MW (CANWEA, 2015). Although RETs are helping Ontario build a stronger, cleaner and more affordable power system many critics of RETs, and more specifically wind farm developments, have been skeptical of allowing RET developments to erect in local communities (CANWEA, 2015). For the purpose of this paper Case studies obtained from European examples of successful wind farm developments will be cross examined with an Ontario wind farm development to correlate common success factors. Moreover, information regarding the different types of discrepancy involved with wind farm developments will be analyzed alongside certain success factors which can be utilized to gain local acceptance of wind farm developments.

Background History of Wind Turbines

Wind turbines have been used for decades as a form of RET. The implementation of electric generation using wind began in the early 20th century with small, independent locations suited for personal use (WEF, 2014). The wind turbines for electrical generation were almost abandoned due to inexpensive oil prices around the world in the early 1950's. However, the oil crisis in the 1970's brought new life to the wind turbine as a sustainable energy source. Wind turbine development carried through until the middle 1980's when again, oil prices began to fall and tax incentives depleted making them an expensive alternative energy form (WEF, 2014). Present day, advanced wind turbine technology has re-emerged as a viable, and sustainable energy form to supplement current fossil fuel technologies. Wind energy is considered a comparable future contender against current energy models such as coal and nuclear energy. This has been very attractive to environmentalists and eco-friendly bodies of government that are looking for ways to implement green energy.

Current wind turbine technology has finally reached a point where implementation can be widespread due to the innovations of wind turbine design; this has been the direction of the European governments seeking to convert to green energy. According to the Betz’s law wind turbines are not able to capture more than 59% of the kinetic energy from wind; 59.3% is known as the Betz’s coefficient and is what developers aim to achieve from each wind turbine (Danish Wind Industry Association, 2000). Current wind turbines are now able to achieve much higher efficiency rates than previous generations, bringing them closer to the Betz's law limit of 59% (Danish Wind Industry Association, 2000). This is due to the new construction methods of the historical horizontal-axis wind turbines (H.A.W.T.). This turbine design works like a car alternator by using a horizontal rotating shaft to spin a generator giving a maximum output of 1.6 megawatts (Wind Ontario, 2014). This output is then reduced to a realistic 30% or ~0.5 MW for the everyday residential use under ideal conditions (Wind Ontario, 2014). Developers of RETs have acknowledged the higher than average prices to develop a single wind turbine when compared to other alternative energy sources such as nuclear plants (Wind Ontario, 2014). The cost for a utility scale wind turbine can range from $1.3 million to approximately 2.2 million dollars per MW of nameplate capacity installed (Wind Ontario, 2014). That being said, most commercial scale turbines installed are 2 MW, thus costing anywhere between $3.5 to $4 million dollars installed (Wind Ontario, 2014). When comparing these prices to the cost of creating a nuclear plant, wind energy production is much more expensive alternative (Wind Ontario, 2014). Regardless of the installed price of a single wind turbine, the payoff arises from the eco-friendly nature of the wind energy, something coal and nuclear energy cannot provide at any cost (Wind Ontario, 2014).

NIMBY

Wind turbines are a product of one of the most mature RETs in the world. Properly deployed wind turbines have low impact on the environment when compared to other RETs and are generally favoured by the public (Klick and Smith, 2007). Regardless of the overall positive attitudes expressed towards green energy, wind turbine projects are often disliked and receive resistance in local communities by individual citizens, political leaders, grassroots organizations, national interest groups, and environmental groups (Klick and Smith, 2007). When there is strong national support for a proposed project but weak local support, the local opposition is said to be motivated by the Not-In-My-Backyard (NIMBY) syndrome (Klick and Smith, 2007).

Many negative perceptions of wind turbines are demonstrated at local levels and thus are classified as Nimby responses. Nimbyism towards certain projects is experienced due to the intense emotional and adamant local opposition to site proposals which are believed to impact residents of local community's adversely (Kraft and Clary, 1991). Nimbyism and the tension caused between local activists and developers can be defined as the most fundamental challenge that is faced by the wind industry today. Activists have offered various reasons why they are opposed to the development of wind turbines in their local communities (Klick and Smith, 2007).

Of these various reasons the most notable have been annoyance due to noise, visual intrusion, electromagnetic interference, harm to birds and other wildlife, and negative health impacts (Klick and Smith, 2007). Each of these reasons will be touched upon in the subsections below to further describe the opposition to wind turbine development.

Noise Annoyance

Claims have been made that noise from the continuous circulation of the rotor blades is inevitable and annoying. Current wind turbines have the capability of producing sound power levels within the range of 33-40 dB (A) at wind speeds of 8 m/s (Pedersen and Waye, 2007). These sound power levels are translated to 33-40 dB (A) on average based upon meteorological and ground conditions for dwellings which are located 500 m away (Pedersen and Waye, 2007). Studies previously conducted on sound pressure levels (SPLs) of annoyance have proven that SPLs lower 40 dB are considered low magnitude and are not considered a problem when arising from other sources of community noise consisting of road traffic and aircraft traffic (Pedersen and Waye, 2007). That being said, low frequencies are able to propagate for extremely large distances, with little reduction of their noise power levels. Low frequencies have the ability to travel without any loss of noise power through walls and windows thus resulting in increased sound pressure levels within rooms leading to variations in sound pressures levels inside the rooms. Although any sound below 20 Hz is consider infrasound and is consider inaudible to the human ear there are some inter-individual differences between people that may allow infrasound to be heard by some. Thus, depending on the source and the threshold of the audible of an individual, community members may react differently to the level of power sounds. Moreover, there is consistent evidence that thresholds within an individual's hearing could expose that individual to experience different low frequency noises (LFN) and higher pitched sounds (Philp, 2011). With long term exposure to LFN due to community settings, such as wind turbine deployment in a local community, there is a potential for community members to have a permanent shift in their hearing thresholds causing the LFN to become less tolerable (Philp, 2011). Animal studies conducted with monkeys and guinea pigs have confirmed this permanent threshold shift as they have shown evidence of deteriorating sense of balance and special orientation; effects of LFN (Philp, 2011).

That being said many different noise disturbances such as sleep disturbances, headaches and nausea have been reported by local citizens who are living in the vicinity of the source regardless of the sound levels emitted (Pedersen and Waye, 2007). A recent study conducted in 2009 surveyed over 700 individuals in the Netherlands through the method of a standard questionnaire (Pedersen, Van Den Berg, Bakker, and Bouma, 2009). For each individual the sound pressure measurements were taken from outside their residents (Pedersen et al., 2009). Each sound measurement was taken through a meter which were equipped with filters which could identify the frequency ranges of the sound being measured outside the residence and aid in approximating the response the human ear (Pedersen et al., 2009). Results from this experiment revealed that a dose-response relationship was present between the level of noise and the degree of annoyance experienced by the home owner (Pedersen et al., 2009). At 30-35 dB(A) nearly 44% of respondents reported annoyance due to the swishing sounds created by the wind turbine blades. At 40-45 dB(A) 32% found this swishing sound annoying (Pedersen et al., 2009). In general, most respondents found the swishing noise created from the wind turbine blades more annoying than equivalent sound pressures from local traffic and air craft (Pedersen et al., 2009).

To expand on preference over more common sound pressures a prime example arises from a survey completed by Pedersen and Larsman (2008) which correlates with the previously mentioned common noise disturbances; noise from an aircraft has been acknowledged to be much more annoying than road traffic noise, which in turn is much more annoying than noise from rail roads. Due to the various factors involved in identifying what SPLs are considered annoying, extensive efforts have been made in Sweden to define the dose-response relationships between various sound levels and the frequency of annoyance with wind turbine noise (Pedersen and Waye, 2007). Twelve different areas within Sweden participated in a cross-sectional study where the dose-response relationship between A-weighted SPLs and noise annoyance with wind turbine noise were proven present, even though these noises were received from wind turbines who had projected less the 40 dB-A outside of the respondents dwellings (Pedersen and Waye, 2007). Throughout the 12 different cross sectional studies on annoyance based on wind turbine noise it became obvious that the visual impact of the wind turbines themselves steered the replies to the annoyance of the wind turbine noise (Pedersen and Waye, 2007). These visual impacts will be further discussed below.

<u>Visual Intrusion</u>

An interview study conducted with residents who reside in close proximity to wind turbines stated that wind turbines spoiled their view of the rural landscape due to the constant movement of the rotor blades always attracting the eye through constrained openings such as windows (better described as the shadow flickering affect) (Pedersen, Hallberg, and Waye, 2007). The scale of the shadow flickering problem is dependent on various factors such as the current wind speed and direction, the exact position and point of the sun as well as the level of cloudiness (Gray, 2011). Residents reported that the shadow flicker problem is most persistent during the hours of the day when the sun is low in the sky; at sunrise and sunset (Gray, 2011). The Department for Energy and Climate Change conducted various studies on the shadow flicker affect and determined that the flickering frequency created due to wind turbine rotation is not a significant risk to human health but in long term cases can be described as significant nuisance and can cause stress to people in constant contact with the flickering frequency (Gray, 2011).

Moreover, residents residing in close proximity of wind turbines have believed that their visual effects and overall presence cause a decrease in their property value. A study conducted by Richard Vyn and Ryan McCullough examined over 7000 home and farm sales in Ontario, more specifically Melancthon Township as well as 10 other surrounding townships located in Dufferin, Grey, Simcone and Wellington counties (Vyn and McCullough, 2014). This location was chosen due to the heavily saturated wind turbine deployment; over 133 wind turbines were deployed between 2005 and 2008 (Vyn and McCullough, 2014). Vyn and McCullough concluded after studying home and farm sales data over a period of 8 years (2002-2010) that wind turbines did not have any impact on the value of surrounding properties (Vyn and McCullough, 2014). Regardless of the sales data, the controversy still remains persistent in some community members (Vyn and McCullough, 2014).

Combination of Noise and Visual Effect

Strong correlations between noise in an environment and negatively evaluated visual appearances have been established as a factor that causes negative attitudes. This has been proven in field studies where people were asked to evaluate annoyances due to traffic noises in various environments (Kastka and Hangartner, 1986). It was determined that traffic noises were less annoying if a visually attractive street was presented together with the sounds of heavy traffic as compared with the same level of noise displayed in a visually unattractive street (Kastka and Hangartner, 1986).

In a more recent study this discovery was taken to newer heights establishing that more pleasant noise barriers were considered less stressful to the overall landscape; the visual appearance in which the noise was being presented caused a specific type of auditory judgment (Viollon and Lavandier, 2002). From this study it was possible to conclude that the design of the noise producing barrier must be considered attractive as a part of the overall landscape, as attractiveness to the landscape can relate back to a positive response to the produced noise (Viollon and Lavandier, 2002). When relating these studies back to the overall perception of wind turbines in rural landscapes, local residents consider the visual aspect of the turbines in their communities unattractive, when coupling this visual factor with the perceived noises that wind turbines emit there is an increased probability of noise annoyance due to the visual unpleasantness.

To elaborate on the visual unpleasantness, a Danish study was conducted to analyze what physical attributes made wind turbines unattractive in rural communities (Pedersen et al., 2007). It was found that wind turbines served as intruders to the land, a feeling which was enhanced due to the height of the wind turbines and the close proximity to local dwellings (Pedersen et al., 2007). Moreover, this study also contributed to the noise annoyance conclusions made regarding visual appearances. The overall height and closeness of a wind turbine to a dwelling, when measured as the vertical visual angle (VVA) contributed to a better prediction of noise annoyance than the actual level of noise emitted from a wind turbine (Pedersen et al., 2007). The VVA is better at predicting noise annoyance due to the fact that the larger the angle of the wind turbine the more feeling of intrusiveness and visual discomfort (Pedersen et al., 2007). This negative feeling and visual discomfort then leads to an overall more negative evaluation of the appearance of wind turbines as vertical objects in the rural landscape.

Electromagnetic interferences

Negative attitudes towards wind turbines are also developed with local citizens of proposed development sites due to electromagnetic interferences (EMI) (Krug and Lewke, 2009). EMIs can be caused by 3 primary mechanisms:

1. Near field effects

Near field effects can be defined as potential threats to radio signals due to electromagnetic fields which are projected from the generator and switching components in the turbine nacelle of the wind turbine (Krug and Lewke, 2009).

2. Diffractions

Diffractions are the product of modified wave-fronts. These wave-fronts are typical altered due to objects interfering in the original wave's path of travel (Krug and Lewke, 2009). The term diffraction arises only once the object which has caused the altering wave-front has reflected part of the signal as well as absorbed part of the signal (Krug and Lewke, 2009).

3. Reflection/scattered

Reflections are much like diffractions but differ in the sense that the interference of wave-fronts are either reflected or obstructed completely between a transmitter and a receiver (Krug and Lewke, 2009). Wind turbines have the ability to transmit and scatter a primary signal. Once a primary signal is scattered a receiver may be able to pick up two signals simultaneously (Krug and Lewke, 2009). In this case the primary signal will be separated into two different signals; the scattered signal would be the one causing the EMI due to the delay in time or distortion compared to the primary signal (Krug and Lewke, 2009).

Electromagnetic interferences to microwave communication link systems is a common factor many communities suffer from due to close proximity of wind turbine deployment (ETHW, 2015). A microwave link is a commonly used communications system that uses a beam of radio waves located within certain microwave frequencies to broadcast and transmit certain information between various locations (ETHW, 2015). In most cases broadcasters utilize these microwave links to send and receive programs from their studios and transmitter locations (ETHW, 2015). Moreover microwave links are used by major cooperation's to carry cellular telephone calls between cell sites as well are send wireless internet services to provide their clients with high-speed internet access (ETHW, 2015). When wind turbines are deployed they pose the threat of transmitting EMI to microwave link networks thus causing cellphones and other services such as internet and television to function incorrectly or completely dismantle the signal to the device all together (ETHW, 2015). Due to these reasons, local residents find wind turbine deployment negative to the overall community technological functionality.

Harm to avian populations

Bird mortality due to wind turbine development is a by-product of large scale wind farms. The mortality of avian populations is considered a very significant adverse ecological impact. Due to the current demand for greener energy and the rush to develop new wind turbine developments, the threat of bird mortality threatens to expand radically (Hogan, 2014). As of today it is estimated that nearly 140,000- 328,000 birds die each year from collisions with wind turbines (this number is an estimated value based off of 58 mortality reported cases)(Eveleth, 2013). Moreover, it has been reported that the risk of death is greater with taller turbines. The factor of height has caused a lot of tension between developers and advocates as developers have proposed developing much larger wind turbines to provide more efficient turbines as they are able to capture high winds (Hogan, 2014). Consequently, with larger wind turbines the expected number of deaths of avian population will drastically increase. It has been noted that future developments will have to consider potential development sites very carefully and consider all potential wildlife impacts when planning the deployment sites to reduce this number in deaths (Hogan, 2014).

Furthermore, bird mortality can be considered a very critical factor to the ecological environment as loss of threatened species as well as disproportionate mortality of top level predators can seriously unravel the integrity of an entire regional ecosystem (Hogan, 2014). With the current wind farm deployment propositions it is estimated that more than 4 million birds will be killed per annum worldwide by the year of 2030 (NWCC, 2015). With this accounted number of avian population dying each year the ecological damage will be catastrophic due to the fact that most susceptible species to wind turbine deaths are those which are keystone species or species which are currently threatened by other human pressures such as hunting (NWCC, 2015). The problem lies with the land on which wind farms are deployed, for example proponents of large scale wind farms favour deployment in rural landscapes which are meagrely vegetated or other funnel like landforms (NWCC, 2015). These characteristics are associated with high density bird migration routes or raptor soaring destinations (NWCC, 2015).

Negative Health Effects

Among the long list of complaints reported by local residents in opposition to wind turbine deployment in their communities, a small proportion of people residing in very close proximity to wind turbines have reported serious adverse health effects such as:

- Ringing in the ears

- Headaches
- Lack of concentration
- Vertigo
- Sleep disruption (Knopper, Ollson, McCallum, Aslund, Berger, Souweine, and McDaniel, 2014)

The reason for these self-reported cases is highly debated and is primarily found in certain types of literature including peer-review studies which have been published in scientific journals, government agency reports, legal proceedings, and lastly the internet including social media and other forums of media and websites (Knopper et al., 2014). Self-reported health effects relate back to the operational effects of wind turbines discussed above; electromagnetic fields, shadow flickering affect, and audible noise due to low frequency noise (Knopper et al., 2014). Moreover some other subjective variables are accounted for negative health impacts such as the nocebo effect, which is a condition that causes individuals to demonstrate symptoms of ill health from something that should be ineffective (Crichton, Dodd, Schmid, Gambble, Cundy, and Petrie, 2014).

After analyzing various published findings it is still unidentified whether or not wind turbines are related to negative health of local residents. Although after consideration of the facts presented in published scholarly articles many may come to the conclusion that various types of conditions can be developed from the extensive thought of wind developments and their unsettling characteristics (Knopper et al., 2014). A prime example arises from the claim of noise annoyance which has been discussed earlier. Although there is no scientific evidence that the noise of wind turbines can be heard many still believe that they hear a noise coming from the direction of the turbines (Pedersen and Waye, 2007). The thought of this noise could cause related adverse health effects such as sleep disturbance. Moreover, it has been acknowledged by health professionals that extensive negative emotional patterns can be formulated by individuals who tend to experience more intensively the levels of annoyance from the wind turbines (WHO, 2011). Negative emotion patterns can include episodes of anger, disappointment, depression or even anxiety as well as other psychosocial symptoms such as tiredness, stomach discomfort, and high stress levels (WHO, 2011).

Moreover, due to the correlation of noise annoyance and visual attractiveness, human harm can also be exhibited by people who reside in close proximity to wind turbines due to the visual attributes continuously displayed. These negative human impacts can be driven by various environmental and personal factors and cannot be triggered by any one specific characteristic of wind turbines. Harm experienced from visual attributes differ based on personal benefits such as economic benefits which certain individuals experience for having a wind turbine deployed on their land, these individuals also experience decreased levels of annoyance when compared to individuals who do not receive any economic benefits, despite similar if not higher exposure to the wind turbines. These harms experienced due to visual attributes are similar to the negative emotional patterns experienced from noise annoyance. The most common of these human harms include stress and anxiety caused from visual discomfort (Chapman, St. George, Waller, and Cakic, 2013).

Furthermore, there has yet to be a published article which suggest that nocebo effects play an important role in self-reported health impacts due to the deployment of wind turbines. That being said, negative attitudes of people in direct contact with other local residents can create a perceived environment of negativity towards wind turbines (Chapman et al., 2013). Psychogenic factors such as negative information circulation between individuals have been shown to impact humans, more specifically their self-assessments following exposure to issues such as local wind turbine deployment (Chapman et al., 2013). Being present in this type of environment can cause adverse health-related symptoms such as headaches, nausea, dizziness, agitation and depression (Henningsen and Priebe, 2003).

Based on these psychogenic factors caused due to negative circulation of information regarding wind turbine deployment it is beneficial to consider the role of mass media when it comes to local acceptance of wind turbines. The role of any type of media has the power to either negatively or positively influence public attitudes towards wind turbine deployment, these attitudes can also alter the responses, and perceived health impacts of wind turbines on residents who reside close to wind turbines (Chapman et al., 2013). To further understand what factors can create accepting attitudes towards wind turbine development in populated landscapes various case studies around Europe will be explored in section 2 of this report. From these case studies we will be able to create a list of what factors have encouraged local residents to create accepting attitudes towards wind turbine deployment in their local areas.

Section 2.0 – What factors influence positive attitudes towards wind turbines in local communities? Evaluation of European locally accepted wind farm developments.

Defining the local framework policies in Germany and France

Before discussing the factors that influence positive attitudes towards wind turbine developments at the local level in France and Germany it is important to review each country's framework policies regarding renewable resources. France did not accept the concept of wind-energy as quickly as Germany. The development process in France started much later and was extremely slow (Breukers and Wolsink, 2006). The development process was only initiated due to the governmental program launch of ECOLE 2005, which stated that 250-500 MW of green energy should be installed by the year of 2005 (Jobert, Laborgne, and Mimler, 2007). As the target for 2005 came close to reality in 2001, France started to realise the potential of wind energy and adopted the program being utilized in Germany. By the year 2005, France has installed 757 MW with an additional 155 MW being developed (Jobert et al., 2007).

Although Europe understands that wind energy is important to develop in order to decrease the current levels of GHGs, some countries are much better suited for the development of wind farms than others. That being said, Germany is a much better contender for wind farm development than France due to the favourable conditions and high wind strengths (Breukers and Wolsink, 2006). In addition to the superior geographical factors, local authorities in Germany are also more supportive of wind energy due to section 35 of the building code which states that local authorities can be forced into accepting wind turbines on their territory if demanded by higher authorities (Jobert et al., 2007). This change in Germany's Federal Building Law gave wind-energy, and more specifically wind turbine development, a privileged status in the sense that local communities were given the option of defining zones for proposed wind farms, but denied the opportunity to refuse them completely (Jobert et al., 2007). This law prohibited opposition from blocking wind projects, but created trust among community members as it allowed local communities to concentrate wind turbine deployments onto one site through community agreement.

When considering this law in Germany it might seem as though wind development is forced upon local communities. That being said there are many other cases in France where local communities have welcomed wind turbine development projects with open arms based on various factors which will be discussed in greater detail below.

What factors help create positive attitudes to wind turbine developments?

Acceptance at the local level can be obtained through 4 main factors:

1. Economic benefits for the local community
2. Approval of developmental site location
3. Appropriate knowledge of the proposed development
4. Community Engagement in the site development

Each one of these 4 factors can help strengthen the attitudes towards wind turbine developments within local communities. Listed below are three prime examples of cases where these factors have been utilized in order to establish positive attitudes towards the development of wind farms within local communities.

Case 1: Région Lorie, Département de la Vendée

Local acceptance based on the factors above have been displayed in Région Lorie, Département de la Vendée during the years of 2000 to 2003 (Nadai, 2006). Local communities recognized that Vendée could benefit from the opportunity of wind-energy development (Jobert et al., 2007). The overall share of tourist passing by the local community suffered severely due to lack of beaches (Nadai, 2006). Based on various tourist reviews completed between the years of 2000 and 2003, a small local company from a neighbouring village proposed developing a small wind farm consisting of 8 wind turbines on the Atlantic coast of Région Lorie, Département de la Vendée as both local economy and tourism could benefit from the development of a wind farm (Jobert et al., 2007).

The idea seemed promising as the local company assured local community members that the landscape would not change much, and would continue to remain useful to all local residents

(Jobert et al., 2007). This local company stressed the fact that the agriculturalist who used the land for cultivation could easily maintain their daily activities and practices after the wind turbine deployment (Jobert et al., 2007). Once the proposal was submitted to the local community of Vendée, the project was immediately supported by the mayor, who stated in a press conference that the wind farm would provide for a local development opportunity, new resources as well as a tourist attraction (Jobert et al., 2007).

The developer set up a headquarters in a close by village, and organized many public meetings with the surrounding local municipalities. One of the main concerns that was brought to the attention of the developer was the number of bird deaths caused by wind turbines annually, a concern the developer had heard many times before (Nadai, 2006). To please the community in this sense, the developer and the mayor integrated an influential association into the planning process. This group suggested that the wind turbines be deployed on a polder near a bird-protection zone to minimize the risks of avian harm (Jobert et al., 2007). Moreover, jobs were created by allowing this site as the deployment site, as analysis of the wind farms impact on the designated site was required to obtain statistics (Jobert et al., 2007). By agreeing to the site, the developer took the first step in gaining the acceptance of the local community in the development of the wind farm. Furthermore, the developer also agreed to sell 3 of the 8 wind turbines to a network of local authorities, Syndicat départemental d'électrification (Jobert et al., 2007). The sale of these 3 wind turbines to the local community authorities allowed for various economic benefits to arise as the community, in a sense, had control over a certain percentage of the electricity grid (Jobert et al., 2007). The sale of these wind turbines won the support for the project from the community as well as from the members of the commission responsible for the wind turbine building permits (Jobert et al., 2007).

Concluding Remarks

Since the completion of the wind farm, tourist traffic has increased significantly. Over 100,000 tourist come to Vendée a year to see the wind turbines and participate in other local traditions (Nadai, 2006). Moreover, the developer conducted a poll to assess the social acceptance of the project one year after the development, and discovered that 94% of the respondents in the local community and 5 other surrounding communities favoured the wind farm (Nadai, 2006). That being said, the fact that 3 out of the 8 wind turbines were owned by the community played a major factor in the local level acceptance of this wind farm in Vendée. The partial ownership of the wind turbines allowed the community to accrue additional economic benefits that would not have been present otherwise (Nadai, 2006). In addition to the directly impacted community, the increased traffic of tourism has played a large role in the local level acceptance of the small wind farm in the surrounding communities as they are also benefiting from the wind farm development (Nadai, 2006). These economic benefits, appropriate knowledge of the proposed wind farm, site acceptance by the local community and community engagement throughout the entire development process contributed to the success of this specific wind farm development and can be considered critical when attempting to gain local acceptance at other proposed development sites.

Case 2: Languedoc Roussillon, Département de l'Hérault

A primary example of properly analyzed geographic territory within a small community is presented in Languedoc Roussillon where EDF Renewable Energies, a local developer who had many projects enlisted in France at the time, had proposed a small wind farm development of only 4 wind turbines (Jobert et al., 2007). The project was proposed at the start of 2000 and was completed in late 2004 (Jobert et al., 2007). The developer gained the trust and acceptance of this community to build and develop a wind farm solely based on the assessment done of an unwanted territory within the community (Jobert et al., 2007).

The site EDF Renewable Energies selected was located on a woody hill in region Haut-Languedoc which was previously used for forestry and hunting (Jobert et al., 2007). The hill was completely invisible from the valley in which the small industrial town consisting of only 2200 community members resided (Jobert et al., 2007). Overtime, the hill had become depleted of its resources and was unintentionally converted into a toxic waste dump (Jobert et al., 2007). The developer had done previous site assessment on this territory, and determined that it was very isolated from the community and could be converted into a small scale wind energy project with some effort (Jobert et al., 2007). Moreover, this community was chosen because it was declining economically, and it could benefit from future economic opportunities (Jobert et al., 2007). The developer brought forward to the community, a proposal for deployment of 4 wind turbines on the toxic waste dump (Jobert et al., 2007).

The small wind farm was received positively from the local community as there was major controversy over the sitting of a toxic waste dump near the community for over a year (Jobert et al., 2007). The residents of the community expressed strong wishes in favour of the development of the wind farm as it was much more positive than the toxic waste dump by comparison (Jobert et al., 2007).

Concluding Remarks

The project was completed in 2004 without any complication. It was concluded that geographical aspects play a large role in the acceptance at a local level (Jobert et al., 2007). Moreover the isolation of the site and its visibility to the local community also played a critical role; minimized visual impact helped strengthen local acceptance (Jobert et al., 2007). Lastly, the declining economic situation persuaded local residents to be open minded about new economic opportunities (Jobert et al., 2007).

Case 3: Central Rhine Slate Rocks Rheinland-Pfalz

The large scale wind farm located in Central Rhine Slate Rocks, Rheinland-Pfalz demonstrates how all the previously mentioned techniques can be utilized simultaneously to gain acceptance at the local level. This case analysis will cover economic growth influences, information based influences, territorial influences and community engagement influences to convince local community members to allow a developer to deploy wind turbines on their land.

Rheinland-Pfalz is considered a unique example of a successful wind farm development as it is developed on a previously owned military zone which was abandoned in 1995 (Zoellner, Schweizer-Ries and Wemheuer, 2008). The possession of the military ground was turned over to the local community, which consists of 19 villages with a combined population of 11,000 residents (Zoellner et al., 2008). Before the development of the wind farm, the community members were very resistant to the thought of development of renewable energy resources in their landscape as their current community is located on a low mountain rage at altitudes of 470m (Zoellner et al., 2008). Due to this specific landscape the visual impacts and sound would be present and very dominant. Moreover, the community is part of a national park, better known as Hunsruck, with a very prestigious climate spa which is visited by countless tourists throughout the year (Zoellner et al., 2008). This climate spa has been designated as the main source of economic growth for the community, and the community members did not wish to risk modifying the current working landscape, as any type of visual or sound disturbance would make their spa less appealing to tourist and thus cause economic decline (Zoellner et al., 2008).

The community members wanted to clear up the previous military zone as there were still bunkers, concrete-covered grounds, and distinctly colored streets altering the landscape (Zoellner et al., 2008). To make the community more appealing to tourists the community members initiated a renovation project themselves. The municipality as a whole thought of a holiday theme park idea which would gain tourists attention (Zoellner et al., 2008). Although the municipality thought the idea good, they were not able to find any investors interested in the development of a theme park. After a series of other suggestions made by community members, the municipality agreed that it would be a good idea to involve the building authority of the community to find a developer that would conceive an energy park on their terms (Zoellner et al., 2008). This energy park would consist of photovoltaic, biogas, and biomass along with wind energy (Zoellner et al., 2008).

A local developer who founded in 1996 the Institute for Applied Material Flow Management a renewable energy company was contacted and preliminary contracts for wind turbine deployment were discussed (Zoellner et al., 2008). Once the municipal council approved the discussed contracts a public information meeting regarding wind turbines was set. At this meeting all questions asked by local residents were answered by the developer. Many concerns were brought to the attention of the developer such as the change to the landscape, noise pollution and visual impacts including shadow flickering, avian deaths, as well as local tourism impacts (Zoellner et al., 2008).

Due to a high level of concern posed by the local community through the spreading of knowledge approach at the community meeting, the developer believed community engagement between the communities was the best approach to create local acceptance of the project. The German Federal Armed Forces were contacted to fly weather balloons over the proposed future sites of the wind farm at a corresponding height (Zoellner et al., 2008). Photographs from these balloons were taken to depict how the wind farm would look with the 14 wind turbines deployed (Zoellner et al., 2008). Moreover, the visual impacts and noise pollution concerns were integrated into the concerns of the negative tourism impacts. This was addressed by the developer by creating a plan of action to integrate the wind farm into the current tourism market which would allow for more economic benefits (Zoellner et al., 2008). To attain a positive local reaction to the proposed ideas, 2 local associations in the field of sustainable development and nature protection were contracted to gain trust of the local community by assuring the site would be monitored for avian deaths and noise pollution (Zoellner et al., 2008).

Concluding Remarks

A final community meeting was held and was attended by 200 inhabitants (Zoellner et al., 2008). The ideas proposed by the developer as well as the level of community involvement in the process of the project had persuaded the community to build the energy park (Zoellner et al., 2008). To seal the deal many economic benefits would be obtained from this development of the wind farm. A call for tender was issued and approved for the energy park with an opportunity for local residents to buy shares in the development (Zoellner et al., 2008). Moreover, because the land was publicly owned the community benefited from tax money as well as rent for the deployment of the wind turbines on the landscape (Zoellner et al., 2008). The German policy framework allowed the community to choose their own developer and design the concept of the energy park alongside the developer. Moreover, the location of deployment was also community chosen, which helped in the process of gaining local acceptance.

Various different methods of gaining acceptance at the local level have been examined through the analysis of different cases within France and Germany. These cases have displayed that through different factors such as distribution of economic benefits, appropriate site selections, correct community knowledge, and community engagement, a developer can create acceptance for wind energy at the local level. Section 3 of this report will examine if these factors are consistent at gaining local acceptance at the local level within Ontario, Canada.

Evaluation of the 4 main factors which induce positive local attitudes

1. Economic benefits for the local community

Van Der Loo (2001) identified looking beyond the NIMBY syndrome and suggested analyzing the Please-In-My-Backyard (PIMBY) syndrome. PIMBY arises when local residents of proposed wind farms gain some source of economic benefit from wind turbine deployment in their local landscapes (Van Der Loo, 2001). Gross (2006) has suggested that the notion of an economic benefit such as financial benefit is a large factor affecting the level of acceptance at the local level. Financial benefits can arise from the possibility of being able to participate in the wind-energy project first hand and have some stakeholder contribution to the overall deployment which can allow for some sort of benefits to be reaped by the local community (Gross, 2006). Benefits can consist of ownership of the entire or part of the wind farm after completion, ownership of the rented territory, tax breaks for the community, or potential income possibilities due to increased tourism or other factors associated with the development of wind turbines (Gross, 2006). These types of economic benefits have been shown to sway negative attitudes towards wind farm developments towards the positive end of the spectrum as seen in the cases above.

2. Site locations approved by local community members

Which site was chosen in the local community and what that site was previously used for plays a large role in whether or not the community will be accepting of the proposed wind turbine development. In certain cases the sites chosen by developers may be of sentimental value to a large portion of a community (Gross, 2006). In other cases the site chosen might be too visible on the local landscape or too close to the local residents (Gross, 2006). Due to many negative factors allocated with site preference and visual aesthetics of turbines and large or small scale wind farms it is critical for the developer to do prior research about the proposed site before suggesting a location to develop wind turbines (Gross, 2006). If these factors are not considered when proposing a wind energy development, the community might see this mode of action as a lack of procedural justice, as the perceived level of fairness and community satisfaction in deployment plays a critical role in reducing local conflicts (Gross, 2006).

3. Appropriate knowledge of the proposed wind energy development

Positive attitudes towards wind farm developments in local communities can be encouraged by increasing knowledge about wind turbines and wind farms (Gross, 2006). Knowledge can varying from extensive product knowledge such as what wind turbines can offer for the environment and how they function to produce green energy, to more common levels of knowledge such as what is being said about wind turbines and their developments in various location (Gross, 2006). Knowledge from word-of-mouth can act as either a positive or a negative factor when considering the attitudes of local communities toward wind turbines (Gross, 2006). As mentioned earlier, media as well as hearing things from other local residents can play a large role in creating local level acceptance of any type of project within a community (Gross, 2006). If negative, misinformed information, or lack of knowledge is present among the community negative outcomes will arise (Chapman et al., 2013). Thus, providing proper information about the wind projects and informing all local residents about wind energy is essential when attempting to gain local acceptance of wind farm developments (Chapman et al., 2013). In addition to having a well-informed community it is critical to have good quality communication between the developers and the public (Chapman et al., 2013).

A study conducted in Germany in late 1997 supports this conclusion. More than 85% of the population of Germany wants to be kept informed about various types of plans that are being discussed regarding wind-energy within their communities (Erp, 1997). When asked who should be responsible for the distribution of this type of information among local communities, 60% of the participants responded that the distribution of information is a job for the local authorities in the municipality (Erp, 1997). Moreover, 5% of the respondents believed the job of information distribution should be handled by provincial authorities and 13% believed it was a task for the local media (Erp, 1997). As of today, many individuals rely on receiving important information about planned local projects through personal friends and the media (Chapman et al., 2013). That being said, there is a huge difference between how people expect to be informed about local events and how information is actually perceived. To gain the trust of the local community it is beneficial for developers to inform the community in which they plan to develop wind farms as this mode of action will help clarify questions of concern to local residents and provide the opportunity for good quality communication between the developers and the public (Chapman et al., 2013). Once good dialogue between the community and the developer is established, the developer can begin to gain local acceptance through the methods of community engagement.

4. Community engagement in the site development

Engagement between a local community and a developer who is proposing a wind energy development project is critical in obtaining local level approval for the project. When a community is well informed about wind energy, and trusts its local planning process, there is less opposition to be dealt with (Gross, 2006). When developing wind energy proposals it is important for the municipalities to encourage dialogue between community members and developers (UNSM, 2011). Dialogue and appropriate conversation between community members and the developer will set the stage for later community engagement and involvement on specific wind energy proposals based on the accumulated education and discussions (UNSM, 2011). The sooner the community is engaged and is participating with the development proposal the less likely the project will face opposition, thus increasing the likelihood that the proposed project will meet the values and expectations of the community in which the project is being proposed to be developed (UNSM, 2011). Community engagement is perceived as a two-way street as it allows for the community to be well informed as well as allows the municipal leaders and project developers to understand the needs of the community first hand (UNSM, 2011).

Planning tools such as policy frameworks can play a large role in the level community engagement required to develop a wind farm (UNSM, 2011). When analyzing the policy framework between France and Germany there are various rules and regulations that the community must abide by, for instance the policy in France allows community members to reject and protest wind energy proposals whereas the good citizens of Germany do not have that option at all, but they do have the opportunity to engage with the developer to choose a site for the proposed wind project (Breukers and Wolsink, 2006). This type of policy framework ensures that developers notify nearby residents before installing any sort of wind energy project as well as allows interested community members to get involved with the project (Breukers and Wolsink, 2006). The community engagement process can consists of any member of the community including residents and their leaders, businesses, institutions and community groups with various ranges of demographics and opinions. The community engagement should be designed based on different types of ages, levels of education and lastly point of views to engage the community at its fullest potential (UNSM, 2011). It is important to consider the community as a rightful stakeholder in the proposed wind energy project.

Concluding Remark

As a common guide it is beneficial to consider a checklist for each proposed development. To have the greatest chances of local level acceptance each factor should be present in the grand scheme of development proposal and deployment. Each case study presented above presented these factors throughout their proposal and development. This factors will now be cross examined in an exclusive Ontario case study.

Acceptance Factor Check List	☑***yes*** ☒***no***
Economic Benefit	☑
Local Site Approval	☑
Appropriate Knowledge	☑
Community Engagement	☑

Section 3.0 –Evaluation of locally accepted wind farm developments. Do specific factors affect attitudes toward the acceptance of wind turbine developments in Ontario, Canada?

Canadian Wind Energy

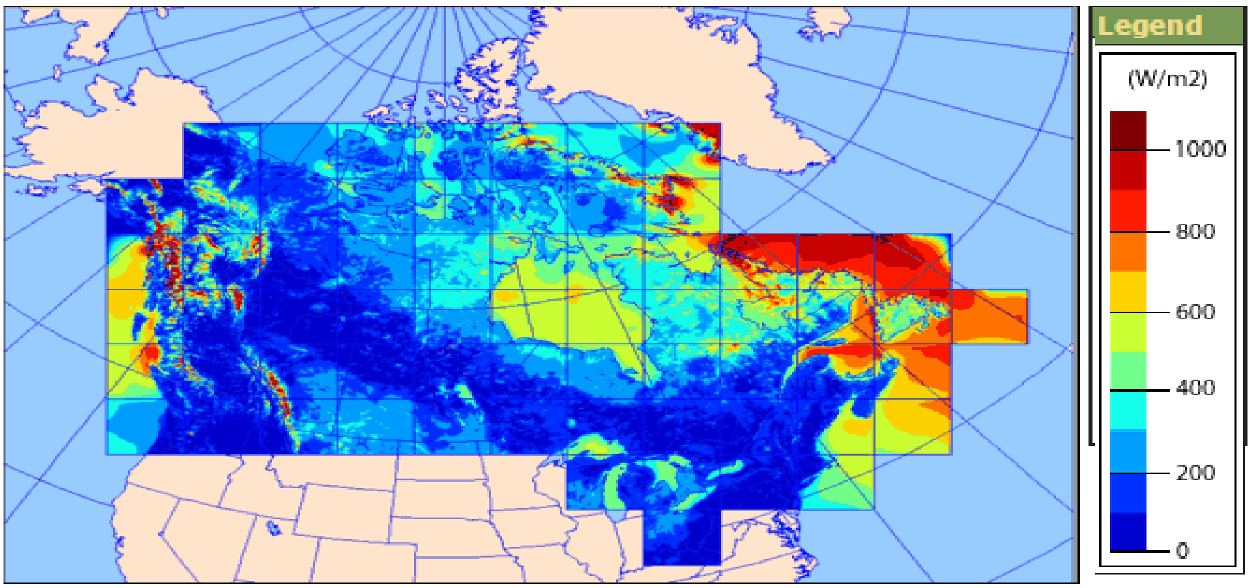
Over the past decade, wind energy development within Canada has been increasing dramatically. 2015 has marked a record for wind energy development in Canada with a total of 37 brand new energy projects developed, totalling over 1871 Megawatts (MW) (CANWEA, 2015). These wind energy projects were constructed and commissioned in various Canadian provinces including Ontario, Quebec, Alberta, Nova Scotia, and Prince Edward Island (CANWEA, 2015). Of these 37 new projects, 16 projects included substantial ownership stakes from the Aboriginals, Municipal Corporations and/or local farmers (CANWEA, 2015). As of today, Canada is placed 7th in the world for installed capacity, thus surpassing the 10000 MW threshold (CANWEA, 2015). Overall, wind energy supplies a little over 4% of Canada's electricity needs with enough harnessed power to meet the demands of over 2.5 million Canadian residences (CANWEA, 2015).

In Canada, each region is classified by the specific wind strengths, or average wind speeds available (Environment Canada, 2003). Environment Canada (2003) has established each regions wind speeds to determine optimum locations for wind turbine deployment (Environment Canada, 2003). Figure 1 shows a map created by Environment Canada that is spliced into 65 regions, indicating where the wind speeds are highest and lowest, giving a developer a general idea of ideal locations for wind development (Environment Canada, 2003). The areas classified as red in terms of wind supply have the best average wind speeds. Due to the mechanics of wind turbines, deployment and large developments are primary completed in areas of high wind speeds to harness as much wind energy as possible (Environment Canada, 2003). Unfortunately, these areas of high wind speeds tend to be located in large open areas and in many cases small rural communities with large undeveloped landscapes.

That being said, wind energy is an extremely debated topic in Canada that requires significant attention geared towards local communities for the consent of capacity development. For the purpose of this research paper wind energy projects developed within Ontario will be cross-examined with the accepting factors discussed in France and Germany to determine the correlation between the listed accepting factors and the level of local acceptance of wind energy developments.

Figure 1: This map is broken into 65 specific regions. The colour patterns indicate the wind speeds (W/M^2) in the regions; dark red having the fastest winds speeds and dark blue regions having the slowest wind speeds.

(Map obtained from Environment Canada, 2003 on February 26th 2016)



Why Focus on Ontario Wind Developments

To date, Ontario is measured as Canada's leader in clean wind energy with a complete installed capacity of 4, 361 MW (CANWEA, 2015). This installed capacity is eligible to supply nearly 5% of Ontarians electricity demands (CANWEA, 2015). Furthermore, Ontario is the first jurisdiction in North America to eliminate coal as a source of electricity generation as of 2012; wind energy has been able to supply more electricity than the conventional coal energy (CANWEA, 2015).

Ontario relies on wind energy to shape a cleaner and more affordable power system as well as increase economic opportunities for the province. Wind energy development has created many new job opportunities in the regions where wind turbines have been deployed (Environment Canada, 2003). These jobs are usually based on temporary contracts and are outsourced to community members who are looking to be a part of the wind energy development process (Environment Canada, 2003). Table one below shows current statistics regarding wind energy in Ontario, 2015 (CANWEA, 2015).

Table 1: This table shows the number of currently installed wind turbines and overall development installation in Ontario. Moreover, the total capacity and average capacity for each turbine in Ontario is also displayed in megawatts.

(Table create from information obtained from CANWEA, 2015 on February 26th 2016)

Wind by the numbers in Ontario (December 2015)	
Number of Installations in Ontario	79
Number of Wind Turbines in Ontario	2,302
Total Installed Capacity in Ontario	4,361 MW
Average Turbine Capacity in Ontario	1.89 MW

Ontario's Policy framework

Before presenting the in depth case study of a large wind turbine development project located in Ontario it is important to review Ontario's policy framework regarding renewable resources. Both the LTEP as well as the PPS will be analyzed briefly:

LTEP

The Minister of Energy released Ontario's LTEP in late December 2013 (Ministry of Energy, 2015). The LTEP was designed to help guide the province for future targets of 600 MW of wind energy development under the Large Renewable Procurement Program (LRPP) (Ministry of Energy, 2015). The LRPP has designed installation of up to 300 MW of wind energy in its first stages with an additional 300 MW of wind energy in its second stages aimed to be established by the end of 2016 (Ministry of Energy, 2015). The overall intentions of the LRPP is to create a competitive procurement process which will consider all input from wind development stakeholders, municipalities and Aboriginal communities to aid in identifying accepted and suitable locations for wind turbine deployment as well as addressing general wind development concerns (Ministry of Energy, 2015).

PPS

The Provincial Policy Statement was issued by the Planning Act, and came into effect on April 30, 2014 (Ontario, 2014). The document provides policy information pertaining to land use planning, and development. It is key to Ontario's policy orientated planning and it sets the guidelines for development to strive for a more effective, and efficient land use planning system (Ontario, 2014). The statement is a representation of the minimum standards in Ontario and "provincial plans are to be read in conjunction with the Provincial Policy Statement" (Ontario, 2014). It supports and promotes smart sustainable growth, and development as it considers all factors that influences and/or are affected. In section 1 of the policies, the statement addresses how Ontario should build strong healthy communities. Subsection 1.6.11 discusses the energy supply minimum requirements. 1.6.11.2 states "planning authorities should promote renewable energy systems and alternative energy systems, where feasible, in accordance with provincial and federal requirements" (Ontario, 2014). Moreover, subsection 1.7 discusses long-term economic prosperity, stating that money should be invested in renewable energy systems, or alternative energy systems (Ontario, 2014). In order for the statement to be correctly implemented by municipalities, planners must have thoroughly read the entire document.

Ontario Case Study: Gosfield-Comber Wind Energy Project (GCWEP)

Brookfield Power Wind - The Developer of GCWEP

Brookfield Power Wind (BPW) is one of the leading power generating, distributing, and marketing operation of Brookfield Asset Management Incorporated (Brookfield Power Wind, 2015). With more than 100 years of experience with privately owner-operated renewable hydroelectricity Brookfield Power has developed over 160 power facilities with over 3800 MW of capacity producing over 13,000 gigawatt hours of electricity each year for Ontarians (BPW, 2015). Due to the success of hydroelectricity Brookfield power has created Brookfield Power Wind (BPW), a sector of the company strictly dedicated to investing in the development of wind energy to produce clean renewable electricity (BPW, 2015). As of today BPW has the largest wind farm operation, Prince Wind Farm (BPW, 2015). For the purpose of relating specific factors to the success of local community acceptance 2 primary wind operations, Gosfield and Comber Wind Energy, developments of BPW will be studied in depth. Both of these wind farms are located in very close proximity of one another and are often considered 1 large wind farm, thus allowing different local communities in the same municipality to be analyzed. BPW began wind deployment feasibility studies and planning for the Gosfield Comber Wind Energy project in early 2002 with a company known as Superior Wind Energy Incorporated (SWEI), which was later purchased by BPW in 2005 (BPW, 2015).

Gosfield Wind Energy is a 51- MW wind farm which is located in Kingsville, Ontario which began operating in 2010 (BPW, 2015). It is comprised of twenty-two 2.3 MW siemens wind turbines and is capable of generating over 132,000 MW-hours of renewable energy (BPW, 2015). Shortly after completion of Gosfield Wind Energy, Comber Wind Energy began operating in 2011 (BPW, 2015). Comber Wind Energy is a much larger wind farm than Gosfield, with 166 MW of capacity located in Essex County, Ontario. Moreover, currently seventy-two 2.3 MW siemens wind turbines are installed and running, creating a total of 94 wind turbines densely packed in this one remote location (BPW, 2015). Figure 2 below shows the location of GCWEP, as well as where each turbine is located.

To complete both projects BPW had contracted over 300 workers, many of which were residents of the local communities themselves (BPW, 2015). Moreover, after completion of each wind farm over 15 permanent jobs were created in operations and maintenance (BPW, 2015). The combined total renewable energy is producing enough electricity to power more than 70,000 homes (BPW, 2015). From these observations, it is obvious that the GCWEP is very beneficial to the province of Ontario, and to all Ontarians electricity demands. That being said, to approve the production of this large scale wind farm and gain local level acceptance many steps of public consultation and site revision were conducted. These steps to development and acceptance at the local level will be observed in further detail below.

Figure 2: This map is broken into 2 specific regions. The top half is a Comber Wind Farm located in Lakeshore, the bottom left hand corner is Gosfield Wind Farm located in Kingsvile,

Ontario. Each Blue dot represents installed and operating wind turbines. The green dots represent new proposed wind turbine locations.

(Map obtained from BPW, 2015 on February 26th 2016)

GCWEP Development Proposal

Any wind power development within the province of Ontario is subject to various regulatory processes and require consent and approval to develop. The GCWEP was subjected to both provincial and federal environmental assessment requirements. Thus, multiple agencies were contacted and consulted with regarding the proposal of development being submitted. A list of key agencies can be found in table 1 below. BPW had proposed to develop the following (Stantec Consulting Ltd, 2007):

1. “ninety-four wind turbine generators (Siemens SWT-2.3-101), each rated at 2.3 MW generating output capacity, with a hub height of 80 metres above grade”

2. “Two 230 kilovolt (kV) transformers”
3. “One 120 kV transformer”
4. “One 6.1 metre high acoustic sound barrier, positioned around the Gosfield transformer, as per Figures 10 and 10b in the Acoustic Assessment Report, continuous without holes, gaps or other penetrations, and having a surface mass of at least 20 kilograms per square metre”, and
5. “two 7 metre high acoustic sound barriers, positioned around the Comber transformers, as per Figure 11 and 11b in the Acoustic Assessment Report, continuous without holes, gaps or other penetrations, and having a surface mass of at least 20 kilograms per square metre”.

Table 1: This table was created based on a large list of agencies BPW contacted regarding the developmental proposal that was submitted to the local municipality. Agency names were obtained from both Stantec Consulting Ltd, (2007) and BPW (2015).

Federal	**Provincial**	**Municipal**	**Conservation Authorities**
Natural Resource Canada	Ministry of Environment (MOE) – Southwest region office	Essex County	Lower Thames Valley Conservation Authority
Canadian Environmental	Ministry of Natural Resources (OMNR) – Chatham Office	Municipality of Kingsville	Essex Region Conservation Authority

Assessment Agency (CEAA)			
Environment Canada	Ministry of Agriculture, Food and Rural Affairs (OMAFRA) – Agricultural Land-Use Unit	Municipality of Lakeshore	
Indian and Northern Affairs Canada	Ministry of Transportation Southwest Region	Municipality of Leamington	
Parks Canada	Ministry of Municipal Affairs and Housing		
Deparment of Fisheries and Oceans	Ministry of Culture – Southwest Region		
Transport Canada	Ministry of Energy – Southwest Region		
Canada Air Navigation Service (NAV Canada)	Ontario Secretariat for Aboriginal Affairs		
	Ontario Power Authority		
	Hydro One		

Gaining local level Acceptance of the GCWEP

Required through Ontario's rules and regulations regarding developments or alterations to existing land, BPW started to gain local acceptance of GCWEP as soon as the application was submitted (Ontario, 2014). BPW displayed 2 out of the 4 main factors discovered in the European examples directly from the initial stages of the project; appropriate knowledge regarding the development through well-coordinated community engagement in the development process. The community engagement included all parties whose rights may have been directly, and adversely affected by the wind energy project. Through the community engagement process BPW consulted with landowners, residents, federal, provincial and municipal agencies, non-governmental organizations, special interest groups and all other parties with an interest in the lands that were affected by the creation of this project (BPW, 2015). Below is a detailed explanation of how BPW communicated with local community members.

GCWEP Communication Tools to Create Well-Informed Community Members

As mentioned earlier, a properly educated community can help gear local level acceptance of wind turbine deployment in local landscapes. Consultation and disclosure has been one of BPWs key components in creating a local level acceptance. A number of methods were utilized through the project development to provide education services and create positive dialogue between BPW and the local community. Table 2 below is a summary of all communication tools used during the development process:

Table 2: Complete list of communication tools used during the development of GCWEP. The table was created using various sources obtained from both Stantec Consulting Ltd, (2007)

and BPW (2015), Newsletters provided to local community members, and local newspapers covering the developmental process: The Essex Free Press, The Windsor Star.

Telephone and Fax	**Internet/Email/News**	**In person consultation and local Events**
Telephone line (collect calls accepted) 1-519-836-6050	contact information for local BPW community liaisons: -Victor Huebert 519-322-0350 / *vhubert@3dgathome.com* -Harry Dick 519-839-4031 / *hldick@gosfieldtel.com* -Ed Brown 519-326-0257 / *ednhelen@sympatico.ca*	Bus tour of an existing wind farm
		leaseholder's social event
		leaseholder meetings and lease holder social gatherings
		4 Public Open Houses • November 19, 2003 @jack miner Public School in Kingsville, Ontario • November 25, 2004 @ the Centennial Central Public School in Comber Ontario • December 7, 2006 @ the Comber community centre in Comber Ontario. • September 12, 2007 @ the Comber community Centre.
	two project specific e-mail addresses	BPW attendance at the Town of Lakeshore public meeting

Toll-free, general wind information telephone line 1-888-327-2722 ext. 6642	1)comments@gosfieldcomberwind.com 2)wind@brookfieldpower.com	regarding renewable energy systems and wind energy systems
		BPW attendance at the Town of Lakeshore public meeting regarding official plan and zoning by-law amendments
fax service 519.836.2493	A Project website www.gosfieldcomberwind.com The site was used to provide stakeholders with current, on-line updates of Project activities and information, upcoming community events, and consultation activities.	BPW attendance at the Essex County public meeting regarding the Background Research Paper - Wind power and Renewable Energy Planning Study
	Project newsletters providing project updates and upcoming activities	

These communication tools were appreciated greatly by the local community members as it allowed for various methods to connect with the builder and create a trustworthy bond. Gary Rennie (2010), a reporter from the Windsor Star interviewed a select group of farmers after the completion of the Gosfield Wind Energy farm. These farmers lived in close proximity of the wind turbines and were very pleased with the way BPW conducted there developmental project stating that the news letters sent to their homes as well as personal visits from the developers helped them understand their lease agreements for the wind turbines on their properties as well as clear up any questions (Rennie, 2010). More specifically, David Morse, a cattle farmer who is interested in signing a lease to have a wind turbine installed on his property in the next round of developments, Victor Wind Energy, had stated "As both a representative of the Town of Lakeshore as well as being a long-term resident, I am in support of the renewable energy development taking place here, I found the newsletters presented by Brookfield very informative and helpful, but I would recommended larger font for the text as it is hard for some of us to read! This project is exciting to the Town of Lakeshore and the development of future renewable energy" (Cross, 2014). Examples of such positive and accepting attitude have been documented due to the well organized and persistent communication between the developer, BPW, and the local community members. These communication tools were also utilized alongside various community engagement activities which will be discussed in greater detail below.

GCWEP Community Engagement

Community Engagement Process

The GCWEP community engagement process began during the first phase of the project in early 2003 when Gosfield Wind Energy development proposal was submitted, and carried into the second phase shortly after with the construction of Comber Wind Energy (Gosfield and

Comber Projects, 2011). To begin the community engagement process it was very important for BPW to gain knowledge and understanding of the community. It is obvious that every community has its own unique characteristics, and thus it was critical for BPW to recognize these unique characters, and make their best efforts to demonstrate their knowledge, and respect for the community (BPW, 2015).

Four public open houses were scheduled within the community, encouraging community members to express themselves, and their opinions and to ask questions, be skeptical, concerned, and/or opposed to the idea of the wind farm in their local community (Stantec Consulting Ltd, 2007). By involving the communities at such an early stage, BPW was given the rare opportunity to communicate successes, milestones of the developing project, and build a track record for positive communications (BPW, 2015). Moreover, through attendance at public town meetings BPW was able to monitor the rhythm of the community, and its stakeholders to create a transparent understanding of how wind turbines are perceived by the community (BPW, 2015). By creating this transparency, potential issues with the GCWEP were foreseen early on, and strategies to address these concerns were formulated (BPW, 2015). The overall goal of community engagement in the early stages of development was geared towards creating an ideal climate that initiates informed, fact-based discussion, understanding, and cooperation through the development process, so that solutions for issues raised by the community could properly, and effectively be addressed.

The GCWEP developers utilized many activities for the entire duration of the development. To gain access to background information regarding the project a website was created which could be accessed on any public server (www.gosfieldcomberwind.com) (BPW, 2015). Moreover community reports and bulletins outlining all the questions, and concerns were received at a local center which were then answered in full detail at consultation open houses (Gosfield and Comber Projects, 2011). For community members who were not able to attend public house meetings a “hotline” or toll-free number was created which had professional workers attending to phone calls regarding the development (CANWEA, 2015). Furthermore, weekly newsletters that included contributions from community members were distributed to the community (Gosfield and Comber Projects, 2011). The GCWEP development team also took it upon themselves to notify all parties within 2.0 kilometers of the proposed wind farm with a detailed project proposal, and personally consulted with all occupants, residents, and landowners within 800 metres of the proposed location of the wind farm (BPW, 2015).

(Gosfield and Comber Projects, 2011)On a broader scale, media interviews with the developers and community members were conducted, as well as advertisements and columns regarding the progress of the GCWEP were regularly updated in the 8 local papers; The Essex Free Press, The Harrow News, The Kingsville Reporter, The Leamington Post, The Leamington Shopper, The Tilbury Times, The Wheatley Journal and The Windsor Star (Gosfield and Comber Projects, 2015). A public advisory committee was also created to help provide support for the wind farm development, which was comprised of community volunteers (Schwab, 2007). Lastly, for interested community members and local officials, a bus field trip was arranged to Huron Wind Park on April 16^{th} 2005 at the developer’s expense to offer a firsthand experience of a well developed and manufactured wind farm (Schwab, 2007). Representatives from Superior Wind Energy accompanied the attendees to provide profession support and to answer any questions (Superior Wind Energy, 2006). The field trip to Huron Wind Park, really helped in gaining a lot of local farmer’s support who were skeptical about the 80m high wind turbines. Shwan Morris, a cattle farmer who owned 300 acres of farm land between Comber and Staples was impressed with the wind project he saw in Huron County, more specifically a project along Highway 21 in Goderich (Schwab, 2007). Morris went on record and stated "I don't think they will cause a problem with my farming after seeing how finished developments operate" (Schwab, 2007)Morris also continued to state that a previous encounter BPW encouraged him to adopt wind turbines onto his property as leaseholders will receive fixed royalty payments (Schwab, 2007). Morris stated "according to the map we'd have two turbines on our property…If they're going to be around anyway, we might as well profit from it," a bold statement which correlates with the critical factor of success; economic benefits (Schwab, 2007).

GCWEP Economic Benefits

Affected landowners were extremely motivated and supportive of the GCWEP as they saw potential to be earning hundreds of thousands of dollars over a 20 year lease. Lakeshore Mayor Tom Bain stated that as soon as BPW made it known it was interested in developing a wind farm in the area, two groups of farmers stepped forward indicating a willingness to lease land.

Many community members were disappointed that only directly affected landowners were benefiting from the placement of the wind turbines in the community. The Windsor Star posted many articles regarding the lack of benefits within the first few years of the proposal based on comments directed at BPW management during open houses. Daniel Schwab, a reported for the Windsor Star had been following the development closely and had the opportunity to interviewed Ian Kerr, a senior manager of the GCWEP, who stated that "Overall there was a positive reception amongst the landowners as they recognized that wind energy projects are compatible with farming operations" (Schwab, 2007). Mr. Kerr went on to state that "…many economic benefits will be present for the entire community" These statements corresponded with the County of Essex's projected economic benefits. At the time rough numbers were calculated for economic benefits which seemed very promising for the community health, and BPW promised to employ residents of the community within an hour's drive of the development, and provide large salaries to workers on contracts of 1-3 years (Schwab, 2007). These economic promises helped steer resistant community members without direct benefits towards supporting the proposed project (Schwab, 2007). Table 3 below demonstrates the total community economic benefits Windsor, Ontario received from the development of GCWEP in 2012. (County of Essex, 2012).

As of today, BPW is paying local landowners approximately $2 million a year in lease payments, which will continue for the next 15 years (20 year contracts were signed in 2010) (City Desk, 2012). Moreover, the GCWEP is generating approximately $400,000 in tax revenues annually for the town of Lakeshore, Chatman-Kent, Essex, and a large portion of the Windsor area (City Desk, 2012). Robert Hornung, the current president of the Canadian Wind Energy Association stated that the GCWEP is a prime example of a successful wind farm development (City Desk, 2012). Hornung continued to state "if wind energy projects are developed with effective community engagement and developed with community partners, these relationships can have significant economic benefits. Rural economic development and diversification are among the key drivers of such projects" (City Desk, 2012).

Economic Benefits from GCWEP (2012)	
Town of Lakeshore	Chatham-Kent, Essex, Windsor Area
➢ $270k / yr. Property taxes for the turbines.	➢ 130k/ yr. Property taxes for the turbines

➢ $150k / yr. Community Fund. ➢ $100k road ditching, repairs, etc. ➢ Upgrading / replacing / improving the Hydro One utility distribution system throughout the project area.	➢ Fifteen permanent employment positions were created. ➢ $400k / yr. local spending for various Operations and Maintenance support services. ➢ Upgrading / replacing / improving the Hydro One utility distribution system throughout the project area.

<u>Local Acceptance of location: Concerns the Community Expressed at the Open Houses</u>

During the 4 open public houses that occurred over a 4 year span beginning in November 2003, many community members expressed their negative views towards the develop of GCWEP. Moreover, opinions were also expressed at events and in local newspapers. Many of the concerns revolved around the placement of the project and the negative effects that would arise due to it being onshore and close to populated communities. Complaints were filed regarding the placement of the turbines in a high traffic bird migration route and public health concerns for residents residing close to a wind turbine. Below is detailed summary of the primary concerns brought forward, and how the developers, BPW, responded to these concerns:

Killing innocent wildlife

Wind turbines have had an extensive effects on wildlife, more specifically on birds and bats (National Wind Coordinating Collaborative, 2015). As GCWEP is partially located in the

Town of Kingsville, the home of Jack Miner Migatory Bird Sanctuary, many community members have had concerns due to the evidence found regarding deaths of birds, and bats from collisions with the wind turbines based on reports obtained from National Wind Coordinating Committee (Open house comments, 2007). The reason for these collisions is due to the changes in air pressure that the wind turbines create due to the constant spinning of the turbine arms, as well as the altered habitat distribution (NWCC, 2015). Rhonda Millikin, the president of EchoTrack Inc. was hired as an outsourced representative to conduct the environmental assessment of GCWEP. Rhonda was present at the last open house to speak in regards to the ongoing concern among some of the community members (EchoTrack, 2007). Rhonda stated that bats are at a greater risk of collision than birds because bats typically fly lower than the height of the turbines. That being said, bats are able to avoid turbine blades well. She continued to state that EchoTrack's research indicated that the potential for mortality for the GCWEP are lower than many already established wind farms located in the province (EchoTrack, 2007). The GCWEP committee members stated that the extensive studies done by Rhonda and her team at EchoTrack concluded that wildlife impacts are extremely rare and over the course of a year are very low thus the development of wind turbines do not pose a threat to the species population (City Desk, 2007).

Public Health Issues Due To Sound Visual Impact

The two main health concerns brought up by community members revolved around the sound, and visual impacts the wind farm development on the community and to the overall environment:

Sound Impacts

There is no secret that these massive turbines produce sound; with large turbine blades moving through air sound is bound to be created by the aerodynamics (Wind Energy Foundation, 2015). Moreover, the sound made due to the mechanics is also inevitable. Overall the complete sound made by the wind turbines truly depends on the design of the turbines, and the total wind speeds (WEF, 2015). Community members who would reside close to the GCWEP complained about the sound and vibration issues they would be facing. The GCWEP developers referred back to government sponsored studies that were conducted in Canada that revealed that these issues do not adversely impact the health of community members in any way (Open House Comments, 2007). That being said, the developers agreed to investigate minimizing blade surface imperfections as well as utilizing sound absorbent materials which would be useful in reducing wind turbine operating sounds (Open House Comments, 2007).

Visual impacts

Community members were very torn between the visual impacts the large scale windfarm would have on the overall appearance of their community (BPW, 2015). Some community members were open to the idea of a large scale wind farm as they believed the wind turbines would generate more tourism into the low density community (Schwab, 2007). Others believed the wind turbines where eyesores that compromised the natural landscape (Schwab, 2007). Many people suggested that the Wind turbines be colored in different colors, and the blinking lights be removed as they were annoying and distracting, but this was quickly addressed by developers (Open House Comments, 2006). The developers recalled that the Aviation Administration’s requires all large wind turbines to be painted white, and to have white or red lights for aviation safety purposes (Transport Canada, 2006)

Furthermore, community members were concerned about a shadowing flicker effect that is created by the spinning of the wind turbines in certain lighting conditions (WEF, 2015). Community members found this shadowing effect very annoying and disturbing. To combat this shadowing flicker effect, the developers of GCWEP suggested to plant trees, and installing window awnings when certain lighting conditions were persistent (Open House Comments, 2007).

Concluding Community Acceptance of GCWEP

Promises of safe and reliable support to maintain and operate the large wind farm as well as the mentioned economic benefits promised by the developer for the entire community helped persuade local residents to support BPW in their development of a large scale wind farm in their local community (City Desk, 2012). Significant public support for the location and the overall project was received from local community members as well as 4 of the 5 County of Essex councillors (City Desk, 2012). Tamara Stomp wished to withhold public support for the project until a future date, as she believed more studies needed to be conducted regarding human health (City Desk, 2012). Currently, political and local support is still strongly after the development was completed and talks of Victor Wind Energy 2016, a new project by BPW, in Windsor is heavily supported by local residents, political figures, and especially local farmers (City Desk, 2012). Mayor Nelson Santos recently stated in a press conference that “the eight years that Brookfield has spent on this project in Kingsville has led to a good partnership, and Kingsville appreciates what everyone has done to bring in this green energy project” (City Desk, 2012). Farmer Murdo McLean, who currently has 3 wind turbines on his property also contributed to the success story stating “at no time in the past few years have I felt uncomfortable with my decision” (City Desk, 2012

Summary and Evaluation of Success factors

In the case of GCWEP, BPW had a very strict community engagement and participatory system in place that was followed step by step to assure that their proposed development was completed according to their timeline. This being said, BPW did an outstanding job of bringing together various forms of community engagement activities to meet the needs of the regulatory system to approve GCWEP. It was interesting that a lot of background information on the community is completed even before the application for development is submitted.

The idea of asking many questions, and doing research on what types of community members are present in the community is also very knowledgeable information for the developers to attain. This information allows developers to understand what aspects of the wind farm would drive the community members to agree to installment. Questions such as age demographic, and main sources of income are huge dividing factors between agreement and disagreement. BPW conducted good research regarding the economic situation and concluded that a large annual income was a head turner to those who would be entitled as well as community benefits.

Moreover, the communication tools used such as the direct developer email and the toll-free hotline created for those community members who were unable to come out to the public community meetings was very beneficial. In many cases community meetings are scheduled at times that are inconvenient for many people due to various reasons. Thus, it was very valuable for a hotline to be created where community members could call in, and get the latest information on the progress of the windfarm development. For those who feel uncomfortable calling into a hotline, letters and local newspaper articles were also printed, and distributed which is very favourable as all the ideas discussed in public meetings could be documented in the local newspaper which gave community members a sense of voice, and allowed them to be publicly heard.

Moreover, the bus field trip to go see a completed windfarm as well as personally consulting with the community members in close proximity to the development site was an essential part of the community engagement process that was practiced by the BPW, and their consultation team. By bring community members to a completed windfarm, skeptical community members were given the opportunity to see, feel, and hear how a completed large scale windfarm operated. Moreover, be personally consulting with community members in close proximity to the wind farms, community members were able to ask very specific questions that pertained to them, and received instant feedback. These personal interactions made a positive influence in the local communities.

Lastly, the open houses conducted through various steps of the development proposal allowed all the success factors to correlate with one another. The open houses set the stage for knowledge and engagement between developers and community members to be expressed. Engagement led to knowledge of where each wind turbine would be placed and great economic benefits for leaseholders as well as indirect benefits for all community members. Moreover the open houses let skeptical and worried community members express their fears and concerns regarding the wind turbines and the overall development. By addressing these concerns and gaining trust among all community members the project was approved and development was completed in 2010/2011.

Concluding checklist for GCWEP

Acceptance Factor Check List	☑***yes*** ☒***no***

Economic Benefit	☑
Local Site Approval	☑
Appropriate Knowledge	☑
Community Engagement	☑

Conclusion

Wind turbines have been an extremely controversial subject since their mass introduction into the energy market. In many cases green energy has become a popular, and more economically beneficial source of energy (Wind Ontario, 2014). Regardless of its renewable energy nature, several activist organizations protest against the poor performance, health concerns, property degradation, and expenses related to the development of wind turbines in their communities (Wind Ontario, 2014). Numerous reports that have both proven, and debunked many of these allegations making it very difficult to side with or against this new form of energy. Needless to say, wind turbines have come a long way from their original designs, and it will take several more years to completely understand the impacts wind turbines cause, both environmentally and economically. The GCWEP has proven to be an influential demonstration of the strengths and weaknesses green energy brings to a community, and how future projects should be considered.

Through this study it is clear that many of the success factors discussed in the European wind development cases can apply in Ontario. After the completion of all community engagement activities, economic benefits were discussed and a site for development was approved by the local community. These factors would not have been completed without the initial application of engaging he community and supplying the community with direct links to appropriate knowledge of the wind development.

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