Wind Turbines in Ontario: An Examination of Perceptions and Potential Health Effects, and How They Relate To Policy and Decision-Making Processes

by

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

Statement of Contributions

The School of Planning permits a manuscript-based dissertation as an alternative to a standard dissertation, and this thesis used the manuscript option. The requirements of this format are stated below along with explanation as to how the requirements have been met. The policy states:

> *Provided it is approved by their advisor and committee, doctoral students may choose to submit an article-based rather than a conventional thesis. An article-based thesis will need to satisfy the following requirements:*
>
> - *Include at least three articles completed as part of their Doctoral research, which are either published and submitted for publication, or in publishable form in peer reviewed outlets of sufficient caliber as deemed by the thesis committee.*
> - *The candidate will be the first author of all or all but one of these articles; he/she will have contributed extensively to the conceptualization and writing of the article of which he/she is not the first author.*
> - *The articles included in the thesis will be different original contributions that are connected by a strong common theme.*
> - *Apart from the articles, the thesis will include an introduction as well as a synthesis and discussion of the material presented in the articles. The synthesis and discussion can be the object a chapter or an extensive conclusion. The student would also include in the preface, their specific role in each article that comprises the dissertation.*

Conventional theses can also include material that has been published in article format. In such cases, however, this material needs to be blended into the thesis in a seamless fashion to respect the flow of its argument.

My advisors and committee members approved a proposal for a manuscript-based thesis. I have met (an in some cases, exceeded) the School of Planning's Policy by: (1) preparing four manuscripts, which were written as part of my research and not to satisfy other degree requirements, for peer-review publication that have been published or submitted for publication; (2) being the first author on all four of these manuscripts; (3) having these manuscripts be unique and original contributions on the theme of wind turbine development in Ontario; and (4) connecting these manuscripts into a dissertation that reads as a unified document with a cohesive narrative by including an introduction, connecting sections and a synthesis of all findings in the discussion of which I am the sole author.

The following dissertation contains six chapters, including an introductory chapter, four manuscript chapters, and a concluding chapter. I am the sole author of chapters one and six, and the first author and main contributor to chapters two, three, four, and five of which two have been published and two are under review as co-authored manuscripts. For transparency, I have detailed contributions by myself and co-authors for these collaborative works:

Chapter 1:

Authored solely by TC

Chapter 2:

Christidis, T., & Law, J. (2012a). Annoyance, health effects, and wind turbines: Exploring Ontario's planning processes. *Canadian Journal of Urban Research*, 21(1 Supp.), 81-105.

TC conceived of this topic, performed the literature review, and wrote the manuscript. JL provided guidance and performed editing. Next/steps synthesis written by TC.

Chapter 3:

Christidis, T., Paller, C., Majowicz, S., Bigelow, P., Wilson, A., & Jamal, S. (2014). Creating and testing a survey to assess the impact of renewable energy technologies on quality of life. *Environmental Health Review*, 56(04), 103-111.

TC, PB, SM, and AW developed the survey content. TC and CP designed a survey distribution approach and delivered surveys. AW and TC performed data input. TC, CP, and SJ performed statistical analysis of survey results. TC was the lead author of the manuscript. SM provided guidance and performed significant editing. Next/steps synthesis written by TC.

Chapter 4:

Christidis, T., Lewis, G., Bigelow, P., & Paller, C. Understanding the relationship between Psychosocial Factors with Sleep, Mental and Physical Health in Residents near Industrial Wind Turbines. *Submitted.*

TC performed the statistical analysis of the survey data and wrote the manuscript. GL and PB provided guidance and performed editing. Next/steps synthesis written by TC.

Chapter 5:

Christidis, T., Lewis, G., & Bigelow, P. Understanding support and opposition to wind turbine development and assessing possible steps for future development. *Submitted.*

TC conceived of the research approach with help from GL, PB and committee members JL and JB. The interviews were performed and analysed by TC.

Chapter 6:

Authored solely by TC

I testify that I am the primary author of the manuscripts in my dissertation, and that the work was dominated by my intellectual efforts.

Abstract

This thesis explores resistance to wind turbine development in Ontario: perceptions of wind turbines, the impact of policy and decision-making on perceptions, possible health effects and how they relate to perceptions, and how to improve policy and decision-making processes related to wind turbine development.

The dissertation is comprised of four manuscripts. The first reviews the literature pertaining to perceptions of wind turbines, and planning practices used for wind turbine development. This paper suggests a connection between current planning and decision-making processes with resistance to wind turbines and reported health effects. The second manuscript focuses on the development of a survey, through a review of the literature, to assess perceptions of wind turbines and quality of life. Pilot testing of this survey is described in the manuscript and the survey was subsequently used for a cross-sectional study of eight communities with wind turbines. The third manuscript is an analysis of the survey results from the cross-sectional study, using factor analysis to extract key themes related to perceptions of wind turbines. The extracted factors were compared to health measures through logistic regression and a relationship between perceptions of wind turbines and health status was found. The fourth manuscript is a case study involving interviews with residents and politicians in communities with wind turbine developments. The study aimed to understand experiences with wind turbines in order to provide suggestions for policy and decision-making processes. A key finding was that perceived inequalities was a common source of opposition.

This work concludes by emphasizing the results of the case study in understanding sources of opposition in Ontario: perceived inequalities appear to be a root cause of resistance to wind turbines. It is suggested that policies that support cooperative ownership would be an effective

way to address resistance while reaching provincial-level goals for the implementation of wind turbines.

Acknowledgements

Thank you to Professors Geoff Lewis and Phil Bigelow for their guidance, support, and for expressing what appeared to be genuine confidence in me when I said I would be moving away and starting a job yet was still going to finish this work. I would also like to say thanks to Jane Law, Laura Johnson, Jamie Baxter, Shannon Majowicz, and Katy Pintar for their mentorship and Claire Paller, Kimberly Schmalz, and Ria Brown for their help. A huge thank you to Siva Sivoththaman (Ontario Research Chair in Renewable Energy Technologies and Health) and the Energy Council of Canada for supporting this work. Further, thank you to the lovely people in the School of Planning and Faculty of Environment who make the student experience great.

Special thanks to my father for his encouragement and to Colin for making me so many cups of tea while I work.

Dedication

To the people I love who aren't here to celebrate this accomplishment with me: my mother Katherine and my grandparents Triada and Peter Pappas.

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1. Introduction

1.1. Context

In 2004 the Ontario government set a goal to phase out the use of coal for electricity generation in the province and intended to instead generate electricity with renewables such as solar, wind, and biogas. Uptake of renewables was initially marginal and to spur development the government introduced the Green Energy and Green Economy Act (GEA) in 2009. On the surface, the act was a creative solution to multiple problems including the recent loss of well-paying blue-collar jobs in Southwestern Ontario that would be replaced with jobs to manufacture components for renewable energy systems (Ministry of the Environment, 2009). The GEA included a Renewable Energy Approvals process (REA) that removed municipal control over decision-making and developers applied directly to the province for approval of renewable energy developments. This was an intentional choice as it was perceived that municipalities were blocking the progress of wind turbine development in the province (Ferguson-Martin & Hill, 2011).

With few exceptions, all of the grid-connected wind turbines in Ontario are located in rural communities (Christidis & Law, 2013). Ontario, like the rest of Canada, has most of its population living in urban or suburban communities (Gordon & Janzen, 2013), with rural communities, which once housed the majority of Canadian residents (McCann & Smith, 1991), seeing significant population loss and economic decline (Stolarick, Denstedt, Donald, & Spencer, 2010). This divide, and the related partisanship, is evident when considering the recent provincial election in 2013, when the Liberal party won a majority of parliamentary seats concentrated in urban areas while the Progressive Conservative party, which ran a platform that included wind turbines as a wedge issue, won most seats located in rural Ontario (Stokes,

2013a). Opponents of wind turbines are well-connected through online communication and social media, which allowed for rapid and wide-spread sharing of negative experiences with wind turbines and likely caused further polarization (Anderson, Brossard, Scheufele, Xenos, & Ladwig, 2014).

A unique outcome of wind turbine development in Ontario was reports of health effects, beyond annoyance, resulting from exposure to wind turbines; these had not been reported in European communities that had been hosting wind turbines for decades (Krogh, Gillis, Kouwen, & Aramini, 2011; E. Pedersen & Waye, 2007). Some opponents, considering themselves a marginalized population in Ontario, perceived the development of wind turbines as a social justice and environmental justice issue, implying that infrastructure known to cause poor health were intentionally placed in rural communities that voted against the current government (Krogh, 2011). There is a history of environmental justice issues in Canada, which has set a precedent for skepticism of government and industry (Elliott et al., 1997; Masuda, Poland, & Baxter, 2010; Masuda, 2011). Similar to past environmental hazards and consistent with risk theory, wind turbines were a new type of infrastructure that populations are involuntary exposed to and as a result there was a perception that non-observable emissions were impacting health (Slovic, 1987). Health risk perceptions were exacerbated by a lack of transparent communication from government addressing perceived risks (Johns Hopkins Bloomberg School of Public Health, 2016).

1.2. Rationale

The introduction of the GEA and REA, despite an attempt to address larger, complex problems, created anger and fear in communities with wind turbines. This thesis aims to explore the

concerns over wind turbines in communities by examining perceptions of wind turbines, potential health effects, and the policy and decision-making processes. This topic was explored through epidemiological and sociological methods and examined how policy and decision-making processes may be related to psychosocial factors that mediate health outcomes. Combined, an interdisciplinary assessment of the opposition to wind turbine in Ontario results.

1.3. Conceptual Model

The conceptual model illustrated in **Error! Reference source not found.** below highlights the indings of this research program while also synthesizing the literature that has been published to date. The pathway from policy and decision-making processes to health effects is proposed in Chapter 2 by synthesizing the evidence available in the literature and speculating that the decision-making process and policy can lead to annoyance, and/or negative perceptions and attitudes towards wind turbines which may lead to health effects. This chapter posits a preliminary conceptual model that has been built upon below. The pathway from wind turbine exposure to health effects is examined through the factor analysis in Chapter 4. The factor analysis establishes that attitudes and perceptions in those living near wind turbines are an important factor in the pathway between wind turbine exposure and health effects. These mediating factors may be attitudes and perceptions or other factors that have yet to be explored. The final research chapter (Chapter 5) explores nearly all of the themes in the conceptual model through interviews with community members. The pathway leading from larger social, economic, and political issues through to opposition is well-established through the interviews.

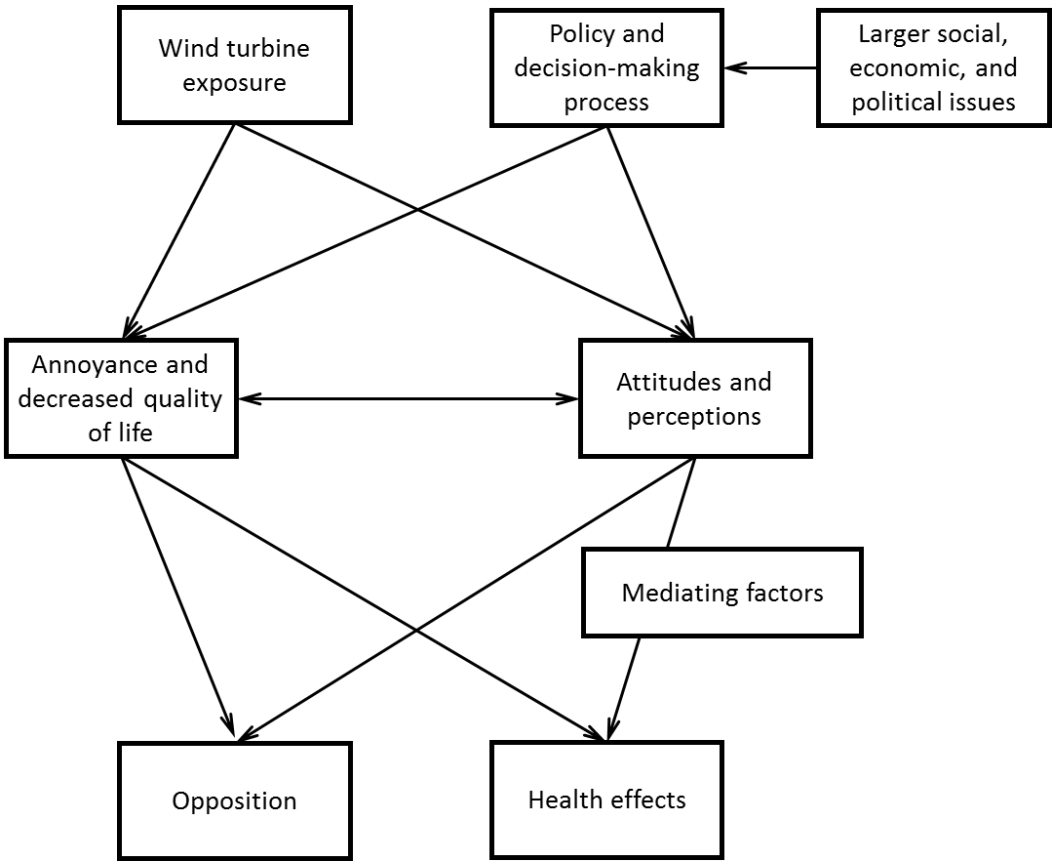

Figure 1: Conceptual model of the relationship between wind turbines and health effects

1.4. Methods and Thesis Organization

This thesis is organized into four manuscripts prepared for peer-reviewed publication, followed by a discussion of the unique contribution of the findings, themes, and application of the results. The first manuscript (Chapter 2) (Christidis & Law, 2012a) is a review paper, acting as a literature review to establish the key themes of the dissertation: health and risk perceptions and how these are related to decision-making processes and policy. The connecting section will describe the rationale moving forward from this literature review and the steps taken to develop research questions and research method to examine wind turbines and health effects. The second manuscript (Chapter 3) (Christidis et al., 2014) is a pilot study that was performed to examine quality of life and perceptions of wind turbines in a population living near wind turbines. The

proceeding connecting section focusses on how the results of the pilot study were used to inform the direction of the cross-sectional research study performed (RETH survey). The third manuscript (Chapter 4) is an analysis of the responses to the RETH survey that address perceptions of wind turbines. This was a factor analysis of three scales and the extracted factors were contrasted with health outcomes. The connecting section following this manuscript describes the questions that were raised by the epidemiological research findings in this work and provides a rationale to broaden the research to examine policy and decision-making processes. The fourth manuscript (Chapter 5) is a case study in which community members were interviewed about their experiences and perceptions of wind turbine development with the intent of extracting tangible suggestions for better decision-making processes and policy to reduce opposition and indirectly address reported health effects. Finally, the discussion section synthesises this body of research, establish its novelty within current academic knowledge, and suggest how it might be applied in renewable energy policy and decision-making.

1.5. Researcher position

This topic was originally presented to me as a public health issue to be examined through epidemiological methods. The research was to be performed under the Ontario Research Chair in Renewable Energy Technologies and Health, a position established to meet multiple objectives, including the expansion of current knowledge of potential health effects related to energy from wind. The chair, Dr. Siva Sivoththaman, was awarded the title through an independent and competitive application process and was administered funding by the Council of Ontario Universities.

I became passionate about the topic as I learned more and as it began to seem that the issue was much larger and more complex than I had originally thought. I do consider myself an environmentalist and I came to this topic with a belief that renewable energy technologies are inherently a positive addition to the province and the globe. My background in public health (BSc and MSc in Health Studies and Gerontology) made me especially interested in reported health effects from a novel environmental stressor. However, I was raised in suburban Toronto and do not have a meaningful connection with rural Ontario. I appreciate that we all have experiences that shape the way that we perceive issues and I feel that I had an open mind and objective perspective at the outset of this work. Over the course of this research I had the opportunity to interact with people who do not see things the same way that I do and I hope that I represented their views accurately and did not let my personal bias impact the objectivity of my analysis. I still believe that renewable energy provides societal benefits and think that the current issues that we face in Ontario should be resolved so that more renewable energy technology can be built.

2. Annoyance, health effects, and wind turbines: Exploring Ontario's planning processes[1]

2.1. Overview

Citizens of communities in Ontario where wind turbines have been built tend to have negative opinions of the developments and complain of health effects. The Green Energy Act in Ontario is a 'top-down' policy which aims to meet renewable energy goals. This review paper will discuss the current planning process used in Ontario for wind energy and make the case for a connection between the wind energy planning process and negative perceptions and complaints of annoyance. A review of the academic literature examining wind turbine planning, perceptions of wind turbines, and impacts on the community will be complemented with a review and discussion of the Green Energy Act and Renewable Energy Approvals Process. It is speculated in this paper that the 'top-down' approach is one of the factors leading to negative opinions and annoyance. Incorporating collaborative planning approaches into the Renewable Energy Approvals process is suggested for Ontario.

Keywords: wind turbines, collaborative planning, annoyance, health, wind energy

2.2. Introduction

Wind energy capacity has been increasing worldwide, and although Canada's total wind capacity is modest compared to countries like China, the United States, Germany, Spain, and India, Canada was ranked fifth among nations for the megawatts of wind capacity installed in 2011 (World Wind Energy Association, 2012). Between 2010 and 2011, Canada increased its wind capacity by over 30%, and the World Wind Energy Association states that Ontario's Green

[1] This paper was published in The Canadian Journal of Urban Research. Permission to reprint the paper was granted via email by the editor. Citation: Christidis, T., & Law, J. (2012a). Annoyance, health effects, and wind turbines: Exploring Ontario's planning processes. *Canadian Journal of Urban Research*, 21(1 Supp.), 81-105.

Energy Act is the sole reason that Canada ranked highly for wind energy growth (World Wind Energy Association, 2012). The province of Ontario passed the Green Energy Act in 2009, and this act aims to both expand the use of renewable energy in Ontario and create jobs for Ontarians in the energy sector (Ministry of the Environment, 2011b).

There have, however, been issues with the Green Energy Act. The wind turbines that have been developed in Ontario have proven themselves controversial among citizens who live near proposed developments and after development, there are complaints about the noise and a range of health effects resulting from the wind turbines (Hill & Knott, 2010). In popular literature there is a long list of reported symptoms resulting from wind turbines: headaches, palpitations, excessive tiredness, stress, anxiety, tinnitus, hearing problems, sleep disturbance, migraine headaches, and depression (Knopper & Ollson, 2011). After reviewing the available grey literature and academic literature, Ontario's Chief Medical Officer of Health (CMOH) concluded that community engagement in wind turbine planning can alleviate concerns about adverse health effects of the wind turbines, and that attitudes towards wind farms and perceptions of adverse health effects may be influenced by perceptions of fairness and equity (Chief Medical Officer of Health, 2010).

The current literature indicates that living near a wind turbine can lead to annoyance (Knopper & Ollson, 2011). There is currently an insufficient amount of research in the field indicating a relationship between wind turbines and health effects beyond annoyance. It is our opinion that the planning process may mediate the relationship between annoyance and wind turbines.

This review paper will start with an examination of the academic literature in the field of perceptions of wind turbines. Following this, the small body of academic and grey literature examining the relationship between wind turbines and health will be reviewed. Then, current

approaches to wind turbine planning in Ontario will be discussed, focussing on Ontario's Renewable Energy Approvals process. A brief introduction to collaborative planning and examples of collaborative planning processes currently being used elsewhere will precede an argument connecting the planning process and the negative perceptions of wind held by Ontario residents who live near wind turbines. A discussion of how to reduce the negative perceptions of wind turbines that citizens in Ontario hold will end by suggesting more collaborative planning processes and changes to provincial policy[2]. This paper will be the first to discuss the problems with the planning process used for wind energy in Ontario, and will offer a unique perspective on the importance of the planning process by highlighting outcomes like annoyance and citizens' concerns for their health which may result from the types of provincial level policies that have been implemented in Ontario.

2.3. Perceptions of wind turbines

There are a variety of factors that may lead to approval or disapproval of wind turbines which have been examined thoroughly in the literature. These factors can be generalized into nine categories: physical factors, contextual factors, political and institutional factors, socio-economic factors, social and communicative factors, symbolic and ideological factors, community factors, personal factors, and environmental factors (Devine-Wright, 2005a; Graham, Stephenson, & Smith, 2009). A few of these are pertinent to this examination of the planning process and

[2] Addendum. On March 22, 2012 Ontario's Feed-in Tariff Program Two-Year Review Report was released (Ministry of Energy 2012a). This document included several suggestions for change to the Renewable Energy Approvals process which the Ontario government has agreed to implement (Ministry of Energy 2012b). Two of the six suggestions are consistent with the suggestions in this article and will be briefly described. First, FIT applications with community support or ownership need more time to mobilize, so application with community support or ownership will be given priority over other applications (Ministry of Energy 2012a). Projects with support or ownership from the community or community organizations will be awarded points for this and 10% of the FIT contract capacity will be put aside for local community projects (Ministry of Energy 2012a). Second, FIT applications which have support from the local municipality will also be encouraged. Applications which demonstrate support from the local municipality will be awarded points in the FIT approval process (Ministry of Energy 2012a). The decision to implement these suggestions indicates that the Ontario government is encouraging participation and consultation in the wind turbine planning process, and this is a positive step towards a collaborative planning process. However giving preference to projects that incorporate collaboration is not equivalent to expecting and requiring collaboration. It is too soon to know how this change in policy will work in practice and whether it will have an impact on participation, collaboration, and reports of annoyance.

perceptions. First, a political and institutional aspect that was identified was political self-efficacy; approval is lower if residents have low political self-efficacy and feel as if they are incapable of influencing the political process (Vecchione & Caprara, 2009; Wolsink, 1989). Another political and institutional aspect that was identified was public participation and consultation; approval is higher when residents are consulted and take part in the planning process (Devine-Wright, 2005b; Dimitropoulos & Kontoleon, 2009; Graham et al., 2009; Hindmarsh & Matthews, 2008). Third, a contextual factor that leads to approval or disapproval is the landscape context; if certain features of the landscape cannot be used or enjoyed anymore because of wind energy developments, this would lead to disapproval (Graham et al., 2009). Fourth, an important socio-economic factor is shareholding and community ownership; perceptions are more positive when there is community ownership of the wind turbines and economic benefits to the community (Devine-Wright, 2005a; Devine-Wright, 2005b). It has been speculated that economic benefits to a community will occur only if community owners invest their profits into the local economy, although community ownership is not important solely because of the economic impact (Phimister & Roberts, 2012). The real impact of community ownership is to change perceptions towards wind turbines (Warren & McFadyen, 2010). So far in Ontario there are no community-owned wind farms and the value of payments that land-owners hosting wind turbines for energy companies receive is not publicized.

Opinions of wind turbines change over time, for example, as time passes they may be perceived as more attractive as they become part of the local landscape (Eltham, Harrison, & Allen, 2008). One study found no change in acceptance of wind farms over the course of fifteen years, but the ability of residents to identify positive characteristics of the wind turbines increased (Eltham et al., 2008). Approval rates are higher in citizens who have previous experience with wind turbines

(Ladenburg, 2010). Positive feelings towards wind turbines can result from thinking that wind turbines make the energy supply secure, that the wind turbines are an attractive feature of the landscape, that they benefit the community, and that they are controlled by members of the community (Eltham et al., 2008; Graham et al., 2009). Wind turbines are less likely to gain approval from citizens who are men, citizens with higher incomes, citizens who frequently use space near wind turbine development for recreation, and neighbourhoods with higher social capital (Ladenburg, 2010; van der Horst & Toke, 2010). Residents of communities with high social capital typically: attend local meetings, vote, volunteer, read the newspaper, have high income, and are 'affluent greys in rural communities' (van der Horst & Toke, 2010). Communities where wind farms have been rejected are more likely to have residents who were employed in the private sector, and own holiday homes in the community. The holiday homeowners are likely to be affluent and put higher value on the landscape (van der Horst & Toke, 2010). One study found that higher education is related to more positive attitudes towards wind energy, yet another found that opinions vary based on education level (Firestone, Kempton, & Krueger, 2009). Residents with a high school diploma are more likely to approve of wind turbines than those who do not have a high school diploma but respondents with a bachelor's degree were more likely to approve of wind turbines than those with a master's degree (Ladenburg, 2010). Although education and income levels are often expected to be correlated, in the case of opinions of wind turbines the two variables do not seem to be related (Pomerleau, Pederson, Ostbye, Speechley, & Speechley, 1997).

The context for a wind power development is complex and reliant on a unique combination of factors; the variety of contextual factors that influence perceptions of wind turbines should not be over-simplified (Fischlein et al., 2010). Although it may seem that negative opinions of wind

turbines are simply the result of NIMBY ('Not In My Back Yard') beliefs, it is worth considering what context the wind energy development is occurring in, and whether there are equitable and/or fair circumstances (Wolsink, 2006; Wolsink, 2007b).

2.4. How wind turbines may affect health

The development of wind energy infrastructure has been met with reports of adverse health effects from nearby residents. The symptoms, described in the popular literature as 'wind turbine syndrome' include, but are not limited to sleep disturbance, headaches, irritability, fatigue, ear disturbances, and difficulty concentrating (Knopper & Ollson, 2011). There is currently a modest amount of academic literature examining wind turbines and health effects, most of it assuming that health effects depend on the distance one lives from a wind farm; however, there is no evidence supporting this assumption (Knopper & Ollson, 2011).

There is uncertainty as to how wind turbines may lead to health effects (Knopper & Ollson, 2011; C. S. Pedersen, Moller, & Waye, 2008; E. Pedersen, Bouma, Bakker, & van Den Berg, 2008; E. Pedersen, van den Berg, Bakker, & Bouma, 2010). It may be that infrasound or low frequency noise leads to physiological or biological health effects, but this theory ignores the spectrum of factors that can lead to adverse health effects (Passchier-Vermeer & Passchier, 2000). The World Health Organization's definition of health describes biological, mental, and social well-being as determinants of health (World Health Organization, 1946). In considering the possible relationship between wind turbines and health, these three aspects of well-being are equally important and can all lead to physiological outcomes (World Health Organization, 1946).

In response to concerns of Ontarians, and in response to the media, the Ontario Chief Medical Officer of Health produced a report that reviewed the available literature on wind turbines and health (Chief Medical Officer of Health, 2010). The report concluded that: (1) there is no

scientific evidence that demonstrates a link between wind turbine noise and reported symptoms such as dizziness, headaches, and sleep disturbance, (2) the intensity of the sound from wind turbines is not sufficient to cause adverse health effects, but can cause annoyance via the fluctuations in sound, (3) low frequency noise or infrasound from wind turbines are below the threshold for expected health effects and there is no evidence showing that the low frequency noise or infrasound cause adverse health effects, (4) community engagement in wind turbine planning can alleviate concerns about adverse health effects of the wind turbines, and (5) attitudes towards wind farms and perceptions of adverse health effects may be influenced by perceptions of fairness and equity (Chief Medical Officer of Health, 2010).

2.4.1. Biological mechanism

Wind turbines produce infrasound, which are sound frequencies that should be inaudible (Berglund, Hassmen, & Job, 1996). A possible mechanism for infrasound to affect the body is that the inner ear is stimulated by infrasound, although sound is typically heard by stimulation of the outer part of the ear (Salt & Hullar, 2010). In the popular literature the suggestion has been made that the infrasound from wind turbines, which is not heard but is instead sensed by the body, is the cause of the adverse health effects resulting from wind turbine (Knopper & Ollson, 2011). The inner ear may also be stimulated by low frequency noise, which can cause mechanical vibration on the body surface near the chest and abdomen and is then sensed by the inner ear (Leventhall, 2006; Takahashi, Kanada, & Yonekawa, 2002). Although it is stated in the popular literature that infrasound or low frequency noise can lead to health effects, there is currently no direct evidence of this although it is still conceivable it affects the body through indirect pathways. It may be that infrasound or low frequency noise leads to physiological or biological health effects, but this is only one of the possible mechanisms – there may be other

mechanisms by which mental and social well-being factors may lead to health effects. It is expected that there is a stronger relationship between social and psychological measures of health with wind turbines compared to biological measures of health, and perceived health effects that are not expressed as physical symptoms are equally valid to perceived health effects that are more easily expressed (Knopper & Ollson, 2011).

2.4.2. Annoyance

With the development of wind turbines, there are a small proportion of residents living near wind turbines who will report experiencing adverse health effects but these complaints are not unique to wind turbines (Knopper & Ollson, 2011). In the past, new technologies which have had rapid and widespread implementation have also caused reported health effects, for example: electromagnetic fields from cell phones or base stations (Berg-Beckhoff et al., 2009; Seitz, Stinner, Eikmann, Herr, & Röösli, 2005; Siegrist, Earle, Gutscher, & Keller, 2005). The symptoms reported by people who live near wind turbines (headache, trouble concentrating, fatigue, dizziness) have much in common with the symptoms reported by residents who live near cell phone towers or use cell phones (Seitz et al., 2005).

When citizens are faced with technologies that are unfamiliar, the potential risk is assessed using intuition and mediated by social influences (Slovic, 1987). Similar to the presumption that electromagnetic radiation from mobile phone base stations and mobile phone usage are detrimental to health, it is currently speculated that low frequency noise and infrasound from wind turbines can also lead to health effects in nearby residents (Salt & Hullar, 2010). The literature that examines the relationship between wind turbines and health effects commonly concludes that wind turbines cause annoyance in a fraction of nearby residents (Knopper & Ollson, 2011). Annoyance is likely caused by the both visual impact as well as the audible noise

that the wind turbine creates; wind turbine noise is perceived as annoying, and people pay attention to more annoying noises for a longer period of time (E. Pedersen & Larsman, 2008).

The audible noises from a wind turbine are described as swishing, whistling, resounding, and pulsating/throbbing, or in more quantifiable measures the noise is loud, sharp, rough, fluctuating, and modulating (C. S. Pedersen et al., 2008; Waye & Ohrstrom, 2002). It may be that the fluctuations in noise from a wind turbine are the highest cause of annoyance, but research shows that annoyance can stem from visibility, swishing of the sound, unpredictability of the noise, and the wind turbine noise at night (E. Pedersen, van den Berg, & Bakker, 2009). Reported annoyance is higher when the wind turbines are more visible (flat terrain compared to rocky or hilly areas) and the visual impact of a wind turbine modifies how annoying the sound is perceived to be (E. Pedersen & Waye, 2004; E. Pedersen & Larsman, 2008; E. Pedersen et al., 2008). Reported annoyance of wind turbines is minimized when there is also loud road traffic noise nearby, and there is a significant difference in reported annoyance dependent on whether a respondent benefits economically from a wind turbine development (E. Pedersen et al., 2009; E. Pedersen et al., 2010).

It may be that the most significant adverse health effects from wind turbines are the stress they cause those who live nearby, and this may be exacerbated by the fact that a landscape featuring wind turbines may have a reduced restorative capacity for residents. Stress and annoyance are important health effects even though they may not be easily measured through physiological indicators (Bakker et al., 2012). Rural landscapes which appear to be more natural, have low ambient noise, and few visual intrusions are more likely to cause annoyance when wind turbines are built (E. Pedersen & Waye, 2008). When there is an expectation that the terrain imparts a restorative quality wind turbines will hinder restoration, recovery, and regaining strength (E.

Pedersen & Waye, 2008). People choose to live in natural settings specifically for their restorative outcomes and these are the types of landscapes where wind turbines are typically installed (Hartig, Mang, & Evans, 1991; Hartig, Evans, Jamner, Davis, & Garling, 2003; Hartig & Staats, 2006; Korpela, Ylén, Tyrväinen, & Silvennoinen, 2010; Laumann, Garling, & Stormark, 2003; Staats & Hartig, 2004). Residents who consider their home and its surrounding landscape to be a restorative refuge and also heavily identify themselves by their home, and claim to be unable to escape the noise and visual impact of wind turbines (E. Pedersen, Hallberg, & Waye, 2007; E. Pedersen & Waye, 2008). Although most residents can hear wind turbines and see flickering light, annoyance is more likely in residents who consider the wind turbines to be intruders (E. Pedersen et al., 2007).

2.5. Wind turbine siting and planning

There is a substantial literature that examines both the wind turbine siting and planning processes (Coles & Taylor, 1993; Dixsaut et al., 2008; Khan, 2003; Sorensen, 2007). This research is useful and informative, as it helps create a standard methodology for identifying preferred sites for wind power development based on criteria such as terrain, land use, and wind energy. However, we must differentiate between the 'siting' and 'planning' of wind turbines - the wind energy decision-making process should not be limited to identifying appropriate terrains and through the planning process should incorporate social and political factors in decision-making, and ideally incorporate opinions of all relevant stakeholders (Janke, 2010; Lejeune & Feltz, 2008; Nadai, 2007; Rodman & Meentemeyer, 2006). The planning process is a crucial step in creating wind power developments that are acceptable to the community especially given examples from other countries where wind turbines face opposition and low social acceptance. In the United Kingdom, wind turbine developments have been met with low acceptance at the

community level as well as low approval rates for development application by local planning authorities (Agterbosch, Meertens, & Vermeulen, 2009; Graham et al., 2009; Gross, 2007; Kaldellis, 2005; Kempton, Firestone, Lilley, Rouleau, & Whitaker, 2005; Pasqualetti, 2011; Toke, 2005a; Toke, Breukers, & Wolsink, 2008; Warren & Birnie, 2009). More specifically in American state of Massachusetts, development in Cape Cod has been met with opposition and arguments about economic feasibility, impact on local wildlife, and the impact on the landscape, both for the innate value of the landscape and the impact that the wind turbines will have on tourism (Kempton et al., 2005; Pasqualetti, 2011).

2.5.1. Wind turbine siting and planning in Ontario

The Green Energy Act aims to create feed-in-tariffs for renewable energy, create new jobs for workers in Ontario, and increase the use of renewable energy sources in Ontario (Ministry of the Environment, 2009). To avoid financial risks and project delays resulting from a growing social resistance, the Renewable Energy Approvals process was altered to streamline the approvals process so that wind energy projects were no longer subject to aspects of the Environmental Assessment Act or the Planning Act (this includes the provisions for zoning by-laws and official plans) (Ministry of the Environment, 2011b). This change to the approvals process means that municipalities in Ontario can no longer regulate wind turbines; however, the policy does enable the government to reach renewable energy policy objectives (Hill & Knott, 2010; Watson, Betts, & Rapaport, 2012a). This was done, according to Ontario Premier, so that "Municipalities will no longer be able to reject wind turbines, solar panels or bio-fuel plants because they don't like them. We can't allow interests to oppose these simply because they don't like them." (Canadian Broadcasting Corporation, 2009). The Premier also stated that the provincial government were “going to find a way through this new legislation to make it perfectly clear that NIMBYism will

no longer prevail when it comes to putting up wind turbines, solar panels and bio-fuel plants" (Canadian Broadcasting Corporation, 2009).

If a wind development proposal meets the criteria set by the Ontario government, then the development can proceed regardless of the wishes of the local government or community. Wind turbines with a capacity of over 3 kilowatts (kW) must get approval from the Ontario government through the Renewable Energy Approvals process and as the capacity of the project increases there are more restrictions regarding where the wind turbines can be placed (Ministry of the Environment, 2011a). Wind turbines with a capacity of 50kW or more must meet minimum setback requirements from features of the built environment (roads, residential dwellings, property lines) and the natural environment (wetlands, conservation reserve, wildlife habitat, woodland) (Ontario Legislature, 2011).

There are three main steps to develop renewable energy infrastructure in Ontario. First, the application is prepared with evidence of environmental studies and community, aboriginal, and municipal consultations (Ministry of the Environment, 2011b). Second, the government will review the application and issue a decision (Ministry of the Environment, 2011b). Third, if the project is approved approvals and permits are issued and permission to being construction begins (Ministry of the Environment, 2011b)

The requirement for public interactions under the Renewable Energy Approvals process is to host a community consultation in the planning stages of the wind development, and host another meeting once the project has become more established (Ministry of the Environment, 2011b). At the first public meeting, which occurs during the applicant's project planning, the public is given the opportunity to ask questions and the project applicant is to make it clear to the public that the plan will evolve based on their comments (Ministry of the Environment, 2011b). In the second

public meeting, the public is given the opportunity to review the completed project reports and proposal (Ministry of the Environment, 2011b).

The Renewable Energy Approvals Technical Report suggests that applicants/developers host additional public meetings, as well create a 'public liaison committee' which would be a group of residents who can participate in the development of the project (Ministry of the Environment, 2011b). The Renewable Energy Approvals guide also suggests, but does not require applicants to be 'a good neighbour' meaning that they should be aiming to create positive relationships between the public, the municipality, and the developer, especially in communities where there is a high level of concern about a wind project (Ministry of the Environment, 2011b). This would include, for example, minimizing the impacts of operation on the community by considering: the use of voluntary agreements to shut down operation under specific conditions, valued resources and minimizing impact on these resources, impacts on tourism, and creating visual barriers (Ministry of the Environment, 2011b).

On one hand, Ontario can be praised for this provincial level policy which streamlines approvals in order to reach policy goals, and standardizes development requirements for wind turbines across the province, but Ontario can also be criticized for creating a policy that undermines planners and community members (Watson et al., 2012a). This 'top-down' method is useful for achieving goals, but an approach that uses collaborative or communicative planning processes may be better suited for wind turbine planning so that the opinions of the community that will be directly affected by the planning decision are included in the decision-making (Nadai, 2007). This is especially important in the planning of wind turbines in Ontario, as the issue is complex and contentious. Although there are developments that create minimal interest or opposition in the community and require minimal engagement with the community, the backlash towards wind

turbine developments in Ontario indicates that this is an inadequate amount of consultation (if it can be considered consultation or meaningful participation at all) (Johansson & Laike, 2007). In Ontario, communities have been limited to a 'commenting role' and feel as if they have lost control over what is developed in their communities despite the public outreach that is mandatory for project approval being referred to as 'consultation' and 'participation' (Watson et al., 2012a). Limiting the voice of the community means that community consultations are viewed as an opportunity for the developer to 'educate' the community in hopes that opinion about wind turbines will shift (Arnstein, 1969).

2.5.2. Moving towards collaborative planning for wind turbines in Ontario

There are two planning approaches that are relevant to wind turbine planning. The first is a 'top-down' decision-making process, whereby decisions are made by politicians or professionals in order to meet policy objectives (Hayden Lesbirel, 1990; Nadai, 2007). The second is a collaborative planning approach, which is a more 'bottom-up' approach that will be discussed later. The Green Energy Act in Ontario and the Renewable Energy Approvals process is an example of a 'top-down' approach.

Collaborative planning is a 'bottom-up' planning process which expects that the role of the planner is to mediate communication between different stakeholders so that they can reach a mutually beneficial agreement over a planning issue (Fainstein, 2000; Healey, 1996). With the collaborative model of planning, especially 'turbulent environments' or 'complex communities' can communicate and negotiate a plan of action in a self-regulated way (Seelig & Seelig, 1996). It is assumed that through collaboration, the consensus found among stakeholders represents the public interest (Seelig & Seelig, 1996). Given the complexity of planning a wind turbine

development and the resultant ‘turbulence’ that may occur collaborative planning may be a useful approach that leads to results which are more favourable for all interested parties.

The theory of collaborative planning assumes, first, that stakeholders do not have fixed interests or hold structural positions. For example: a structural position could be ‘capitalist’ and when it is assumed that a ‘capitalist’ stakeholder has rigid capitalist beliefs on all issues there appears to be no value in collaboration and discussion. Collaborative planning assumes a ‘capitalist’ stakeholder, or any other stakeholder, will not reflexively follow a certain belief system when there is discussion and collaboration among a variety of stakeholders (Fainstein, 2000). A stakeholder may protest a wind turbine development initially, but perhaps with communication among stakeholders with a goal of finding compromise, flexible viewpoints that are held by stakeholders can be expressed. Unlike other planning approaches where planners can interpret the public interest and apply their expertise or preferred planning principles to a situation, collaborative planning is a process that defines and limits the role of the planner to a facilitator between stakeholders (Seelig & Seelig, 1996).

In the case of wind turbine siting, decisions are often made by experts, but the consequences of the planning decisions are felt entirely by the citizens who live nearby, although this process is not unique to wind turbine planning (Simao, Densham, & Haklay, 2009). Stakeholders from the community have the capacity to offer local empirical knowledge to the planning process as opposed to scientific-based knowledge that may be offered by ‘experts’ (Simao et al., 2009). The planning process should instead incorporate experts from many different fields along with community members, while encouraging collaboration in finding a solution to wind turbine planning and siting that is a compromise for all parties. Many citizens may approve of wind

energy and a heavier reliance on renewable energy, but will oppose specific developments (Bell, Gray, & Haggett, 2005).

Discussion of collaborative planning techniques for wind turbine siting has been limited in the academic literature. Collaborative planning has been facilitated through the use of internet-based spatial decision support systems or virtual reality programs which allow stakeholders to visualize or create wind turbine siting scenarios which could then be shared with other users/stakeholders and subsequent online discussion can occur (Bishop & Stock, 2010; Simao et al., 2009). There are many examples in other fields where web- and computer-based technologies were used to enable the collaborative planning process (Alshuwaikhat & Nkwenti, 2002; Bishop & Stock, 2010; Coors, Jasnoch, & Jung, 1999; Simao et al., 2009).

A 'real-life' example of collaborative planning is one where key players from macro, meso and micro levels of organization interact through three stages (Despres, Brais, & Avellan, 2004). First, the problem is collectively diagnosed and the challenges to change are identified (Despres et al., 2004). Second, the orientations and objectives of the key players involved are defined from perspectives like sociodemographic, ecological, and economic aspects (Despres et al., 2004). Third, through participation and communication, a development plan and strategy is established with consensus (Despres et al., 2004). This general method has been used for national forest planning, suburban retrofitting, and watershed planning, so a non-technology-based collaborative planning process for wind turbines is could also follow this method (Despres et al., 2004; Singleton, 2002). It should be noted that by the nature of an open planning process, a proposal will face scrutiny from a range of stakeholders, which means that the resultant wind farm will not be a surprise to residents, and may result in less negative opinion (Ellis et al., 2009).

There are drawbacks and criticisms of collaborative planning. An emphasis on communication and collaboration downplays the importance of the social and economic context, the processes used for spatial public policy once consensus has been reached, and the importance of theory in planning decisions (Huxley & Yiftachel, 2000; Tewdwr-Jones & Allmendinger, 1998). It may be idealistic to assume that stakeholders representing different or opposing viewpoints can reach consensus or resolution; reaching a settlement and resolving that there are differences of opinion may be the most realistic option (Stevenson, 2009). This critique has been discussed specifically within the context of wind turbines and even if consensus is not found, it still a preferred method of governance for wind turbine planning (Ellis, Barry, & Robinson, 2007).

2.6. Using the planning process to reduce the negative effects of wind turbines on citizens

Research articles in the field of wind turbine planning and wind turbines and health often state that the planning process is a source of tension that may be connected to, and must be alleviated before, the health effects of wind turbines can be addressed (Jobert, Laborgne, & Mimler, 2007). Wind turbine developments are planned and sited with minimal community consultation which likely leads to decreases in social-psychological variables such as locus of control, self-efficacy, and social capital, and it may be that this results in real and perceived health effects (Lachman & Weaver, 1998; Mandarano, 2009). Wind developers, citizens, and academics from the UK have discussed from multiple perspectives, that wind power has become a multi-faceted planning problem, especially since the planning process has focussed mainly on streamlining the approvals process and not emphasizing the need for stakeholder engagement and input (Ellis et al., 2009). This is largely the case in the Canadian province of Ontario where provincial legislation dictates wind turbine siting and setbacks, leaving municipalities and citizens without power or input in the planning process (Watson et al., 2012a). Although this is an efficient way

to meet green energy goals, streamlining the decision-making process downplays the importance of social interaction with the planning system (Ellis et al., 2009). Planners and researchers must continue to try to understand what enables or impedes the social acceptance of wind turbines and begin advocating incorporating social acceptance into the planning process (Ellis et al., 2009).

2.6.1. How can collaborative planning result in reduced annoyance?

It may be that a collaborative planning process could lead to decreased reporting of annoyance for three reasons. First, because it is unlikely that wind turbines will be placed close to homes or in locations that mar a valued visual landscape if citizen stakeholders are given an opportunity to take part in the planning process. Second, because the collaborative process may result in acceptance of wind turbines so that locations that are close to homes or that predominate on the landscape will not be perceived as annoying. Third, incorporating and showing respect for the opinions of people who will eventually live near a wind turbine development will likely make them less resentful of the development in question, potentially avoiding negative social-psychological effects, annoyance, and stress. The relationship being presented here shows that the planning process creates wind turbine developments but also leads to annoyance, negative psychosocial factors, and stress (Figure 2). Wind turbines can cause annoyance and psychosocial stressors and could potentially cause other health effects, but the latter has not been established. Social-psychological factors like sense of control, mastery, and social capital, are likely to be impacted by collaborative decision-making processes or the lack thereof (Holgersen & Haarstad, 2009; Lachman & Weaver, 1998; Mandarano, 2009; Woltjer, 2002). As has been done with large-scale energy projects in the past, a social impact assessment on the Green Energy Act and Renewable Energy Approvals process could have predicted, before implementation, the subsequent complaints of annoyance and any other consequences that have impacted

communities, and addressed beforehand as a preventative measure (Cocklin & Kelly, 1992; Freudenburg, 1986).

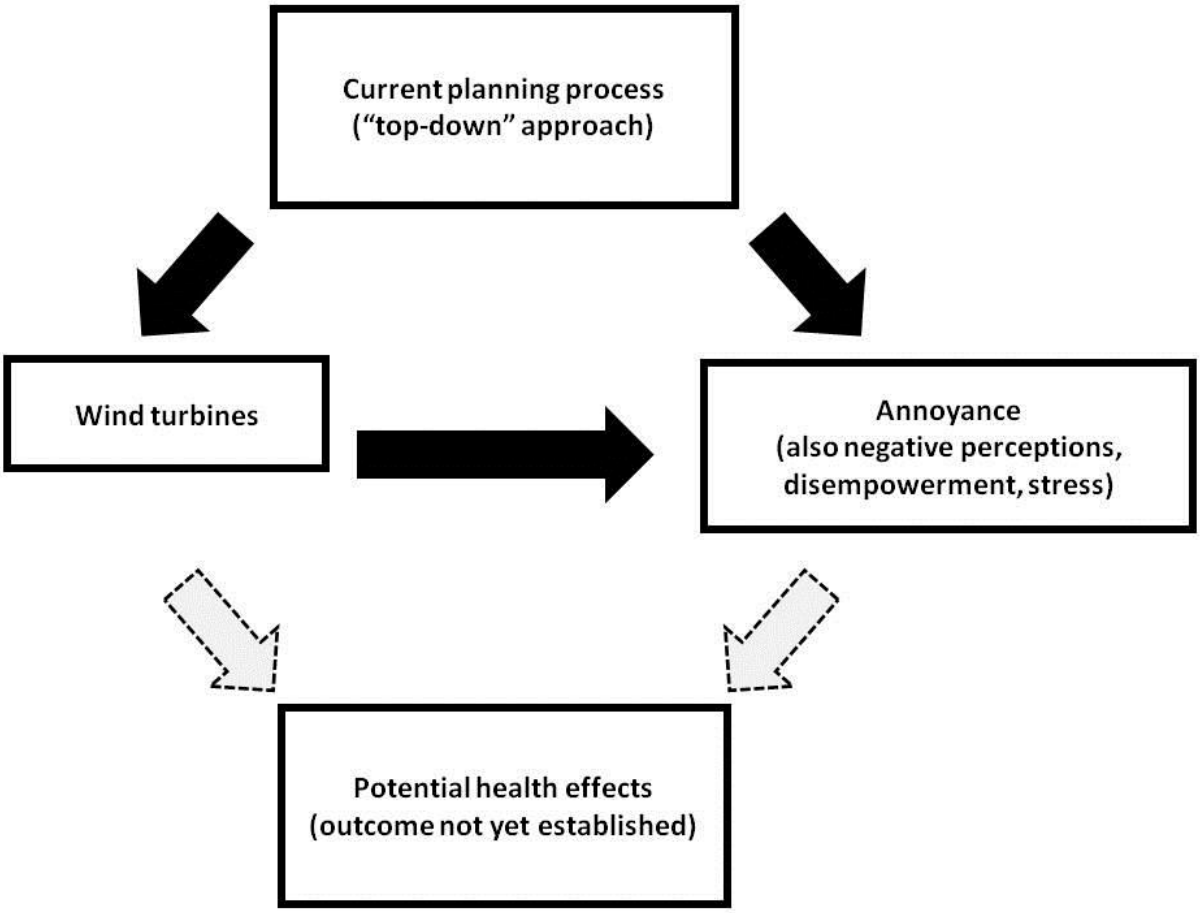

Figure 2 Speculated pathways between the planning process, wind turbines, annoyance, and health

One of the reasons that the Renewable Energy Approvals process was implemented was so that Ontario's renewable energy goals would be met and risk would be reduced for potential investors (Canadian Broadcasting Corporation, 2009). Germany, a country with a much larger wind energy capacity than Canada, gives communities a voice in the development and planning of wind turbines and this does not hinder development, as seen by Germany's substantial wind energy capacity (Jobert et al., 2007). Changing the planning process would likely change how

wind farms are implemented and hinder the province's ability to meet renewable energy goals (Warren & McFadyen, 2010). The scale of developments, if decided by a community, would likely be smaller and at a more devolved scale than is currently the norm, with less wind turbines and smaller wind turbines (Ellis et al., 2007; Jones, Orr, & Eiser, 2011; Warren & McFadyen, 2010). Small-scale renewable energy developments are viewed as an active way for communities to take park in generating renewable energy and large scale-developments are instead owned by private developers and passively 'hosted' by communities (Devine-Wright, 2011). Smaller wind farms do not benefit from the cost reduction that results from economies of scale, and a larger number of small wind farms can be resource intensive from an administrative perspective compared to a smaller number of small wind (Warren & McFadyen, 2010). Given that approval of wind turbines is higher in citizens who have previous experience with wind turbines, it may be that even if collaborative planning initially leads to smaller scale wind projects being developed (Ladenburg, 2010). Once members of a community are comfortable with the technology it may be possible to increase the scale of developments with community approval.

It may be that giving a community a voice will result in stakeholders staunchly opposing wind turbines. If that is the case, opposition may lead to creative problem solving and alternate schemes; there may be resolution where a community prefers to have other forms of renewable energy developed or community-wide energy conservation initiatives over wind turbine development to combat climate change (Ellis et al., 2007).

2.6.2. What can a planner or policy-maker do?

Although the Renewable Energies Approvals process may have been implemented to ensure that Ontario meets green energy goals, this method has resulted in a loss of control for citizens and municipalities, and negative opinions of wind power developments. Although a wind turbine

planning process that is focussed mainly on streamlining the approvals process is an efficient way to meet green energy goals, focussing effort on improving the speed of the decision-making process downplays the importance of stakeholder engagement (Ellis et al., 2009). It may be time to reassess our wind energy policy and planning practices, especially in Ontario. There may be better approaches that encourage implementation of wind power while minimizing negative impacts on the community. Consideration should be given into making the 'good neighbour' suggestions in the Renewable Energy Approvals guide a requirement for all wind turbine developments as well as changing guidelines regarding required setbacks, ownership models, and required community involvement. The wind turbine planning processes in Germany and France are similar to Ontario in that regional government can approve the development but the actual locations where wind infrastructure can be built can be determined by the community (Jobert et al., 2007). Allowing communities to regulate wind development to places that they prefer reduces fear and distrust between the community and the wind developer, resulting in higher levels of social acceptance than we may have seen in Ontario (Jobert et al., 2007).

Comparisons between different jurisdictions show that there is no standard reaction to wind turbine developments; there are differences in terms of the sources of wind turbine conflicts, how these conflicts are resolved, and the expectation of citizen involvement in the planning process (Jobert et al., 2007; Wolsink & Breukers, 2010). Implementation and planning of wind energy varies by Canadian province. Setbacks from an off-site residential dwelling can be as low as 175m from in Nova Scotia to 1 500m in Ontario, and although municipal government regulates wind development in Nova Scotia the provincial government regulates wind development in Ontario (Watson et al., 2012a). These discrepancies mean that planners in Nova Scotia have a significant responsibility in determining appropriate setbacks and Ontario planners have no

control over wind development in their jurisdiction (Watson et al., 2012a). Since there is no standard effect of wind turbines on nearby residents, it is fair to look upstream at policies and planning processes to assess why there are such large discrepancies in public opinion and perceptions. Opposition to wind projects in Germany where there is economic participation, early involvement of key stakeholders, and local government participation is relatively low compared to England and the Netherlands where these methods are less prevalent (Jobert et al., 2007; Wolsink, 2006; Wolsink, 2007a) . In Ontario the planning process does not incorporate community trust and empowerment which is part of the planning process places like Germany and France (Jobert et al., 2007). This may result in the conclusion that a more collaborative planning approach is appropriate in Ontario, where there is no incentive for developers to consult with and accommodate the opinions of the community (Simao et al., 2009).

There are indicators that can be used to determine if there is adequate community participation, which may be adopted into an approvals process to mitigate opposition and subsequent annoyance (Loring, 2007). Evidence that a variety of participants being involved in the planning process, that barriers to involvement in participation were minimized, and that decisions were made collectively by community members, planners, and developers, could be added into the Renewable Energy Approvals process so that only projects that meet minimum standards for collaborative planning and community participation will receive approval for development (Loring, 2007).

Another option is adopting a policy for community-based wind power projects is a promising option in Ontario (Toke et al., 2008). If wind turbine developments lead to a economic benefit that could be shared by many of the nearby residents, either as compensation or through

ownership, then citizens may feel more empowered, and be less opposed to wind power developments (Bell et al., 2005) .

2.7. Conclusions

This article addresses the annoyance and health concerns that citizens in Ontario have towards wind turbines, by reviewing the academic literature in this field from other nations. The provincial level renewable energy policy in Ontario is contrasted to the literature that discusses planning processes. Based on this, more collaborative planning processes and policies that empower citizens, as have been used elsewhere, may mitigate annoyance and negative opinions of wind turbines in Ontario. The Green Energy Act and Renewable Energy Approvals process in Ontario does not give citizens or municipalities control over the development happening in their community, and this needs to change. It is likely that negative opinions, annoyance and stress will be reduced with a new decision-making model.

Although the Green Energy Act and Renewable Energy Approvals process is an efficient way to reach renewable energy goals, the opinions of citizens and municipal planners are not being incorporated into decision-making. The movement towards green energy in Ontario may benefit from a different planning process for wind energy as well as different economic models which benefit the communities hosting the wind turbines.

2.8. Next steps/synthesis

The results of this review helped determine the direction I wanted to take with my research. Originally, I had planned to assess wind turbine exposure and health outcomes using a variety of data sources and using geospatial approaches. For example, using the Canadian Community Health Survey (CCHS) results and comparing communities before and after wind turbines were operational. The use of this data was explored but was found to be unsuitable.

First, there would be limitations to the research findings using an approach such as this one. Wind turbines are distributed sparsely and most wind turbines have been built in rural parts of Ontario where the population density is low. This means that in many cases there are only a small number of people who are 'exposed' to wind turbines in a way that is meaningful to this research and that these people are dispersed over a relatively large area. The available data from datasets such as the CCHS are lacking when used for specific rural communities. The data have geographic information at the three-digit postal code level, which is too broad to find the population of interest in communities with wind turbines and in some cases only a handful of people would be surveyed from a three-digit postal code. The nature of these data is that the same residents would not be surveyed year after year, and in rural communities very few people are surveyed in each postal code.

Second, because of a lag between when data are collected and released, there would be inadequate data collected after wind turbines are operational to assess whether or not health status of a population changed. The 2009/2010 CCHS was available in late 2011 yet most wind turbines in Ontario (and all of the most controversial ones) were developed after the implementation of the Green Energy Act in 2009, which means that in the best-case scenario there would be one survey cycle representing a community after wind turbines were operation,

which is inadequate for a time-series analysis. Population-based surveys are not meant to summarize specific experiences at a local and personal level.

Third, after reviewing the modest literature in this field, it appeared that possible health effects were not necessarily a purely physical response to an environmental stressor and that it would be more interesting to examine the issue of wind turbines and reported health effects from a different perspective. The role of perceptions appeared to be important and these perceptions were formed by a variety of factors, including the process by which wind turbines were deployed in Ontario. Allowing residents to express themselves and to report their experiences seemed crucial for good research.

Around the time that this review paper was written, the research group that I was part of, run by the Ontario Research Chair in Renewable Energy Technologies and Health (ORC-RETH) was in discussion regarding a cross-sectional survey to examine possible health effects resulting from exposure to wind turbines, the RETH survey. I had previously published two review papers, one examining the use of GIS in wind turbine research (Christidis & Law, 2012c), and the other discussing epidemiological study designs for wind turbine research and their strengths and weaknesses (Christidis & Law, 2012b). I realised that this was an opportunity to apply the knowledge that I had acquired from previous research while also reframing the thesis topic. The RETH survey would provide a path to examine not only health effects but also perceptions of wind turbines and wind turbine development. If perceptions were an important part of this research topic, then the survey would be able to provide insight in a way that standardized community health surveys could not.

The goals of the research group were to determine whether health status was related to wind turbine exposure. I was a leading force in designing the RETH survey, reviewing survey content,

selecting communities, and designing distribution methods. Measures of health included satisfaction with life, sleep quality, quality of life, and common symptoms. The RETH survey will be described in greater detail in Chapter 3. Along with standardized scales that assess health, the RETH survey inquired about perceptions that may have been influenced by the planning process and policy. The questions in this section were based on a review of the news and literature and tweaked to address specific issues in Ontario.

The questions I was interested in learning about were focussed on perceptions, planning, and health:

Is exposure to wind turbines related to health effects?

Which aspects of health are related to exposure?

Is there a dose-response relationship?

What are the perceptions of wind turbines among those living nearby?

Are perceptions of wind turbines related to health effects?

How do residents perceive wind turbine development and policy in Ontario?

Are there perceived inequalities in development?

These questions, and many more, were incorporated into the RETH survey distributed by the ORC-RETH group. The second published paper describing a pilot study of the impact of wind turbines on quality of life using this survey instrument, follows in Chapter 3.

3. Creating and Testing a Survey to Assess the Impact of Renewable Energy Technologies on Quality Of Life[3]

3.1. Overview

With the increasing concerns regarding fossil fuels and nuclear energy, greater attention is being placed on alternate renewable energy technologies (RETs), such as wind, solar and bioenergy. However, implementation of modern RETs has become controversial, with adverse health effects being a major concern. Although local case studies have suggested a relationship between wind turbines and health, there is a gap in the scientific knowledge. Epidemiological studies with adequate data collection tools and analyses are needed, particularly in the Canadian context. We reviewed surveys used in relevant environmental health literature, created a data collection tool for use in populations exposed to wind turbines, and piloted the survey content and distribution method. The pilot response rate was 25.5% (45/200). The mean age of survey respondents was 57.6 years (SD: 12.76) with 57% of the respondents being female; respondents were not significantly different than the target population with respect to age or sex. The survey and methods presented here can be used in future studies to assess the health impacts of renewable energy technologies.

Key words: wind turbines, renewable energy technologies, health, quality of life, noise, survey design

3.2. Introduction

Wind turbines are an emerging phenomenon, and concerns about the health impacts from nearby wind turbines exist. Case studies and self-reported surveys have identified possible health effects

[3] This paper was published in Environmental Health Review. Permission to reprint the paper was granted via email by the editor. Citation: Christidis, T., Paller, C., Majowicz, S., Bigelow, P., Wilson, A., & Jamal, S. (2014). Creating and testing a survey to assess the impact of renewable energy technologies on quality of life. *Environmental Health Review*, 56(04), 103-111.

including decreased quality of life, sleep disturbances, headaches, stress, anger, depression and increased use of prescriptions (Nissenbaum, Aramini, & Hanning, 2012; E. Pedersen, 2011; Shepherd, McBride, Welch, Dirks, & Hill, 2011). According to Shepherd et al. (2011), wind turbine farms can negatively impact health-related quality of life by impacting sleep quality and annoyance, leading to a chronic stress response resulting in diminished physical and environmental quality of life. Public Health Ontario concluded that noise and visual impacts of wind turbines are concerns but that these concerns must be interpreted within the broader context of our energy demands and the outcomes of other energy production methods (Copes & Rideout, 2010).

Currently, the specific symptomology and prevalence of health effects resulting from wind turbine exposure is unknown (E. Pedersen, 2011). The shortage of epidemiological evidence indicating that wind turbines lead to health effects, especially in the Canadian context, was highlighted by the Chief Medical Officer of Health (CMOH) of Ontario in May 2010 in a review of the available literature (Chief Medical Officer of Health, 2010). To address the lack of evidence and concerns from Ontario residents, an Ontario Research Chair in Renewable Energy Technologies and Health was established by the Ministry of Environment and research is now underway at the University of Waterloo to address the technological, health and safety aspects of renewable energy. Therefore, the objective of this paper was to describe the creation of a survey to assess possible health effects related to living near wind turbines, as well as to pilot test the survey in an Ontario community with wind turbines.

3.3. Methods

We searched Medline (via PubMed) and Web of Science using the following terms: environmental AND (noise OR odour OR odor OR wind turbines OR wind energy OR solar

panels OR photovoltaic OR bioenergy OR biofuels OR biogas) AND health AND (survey OR questionnaire), for studies published in the last ten years (2002-2012). Themes relevant to comparable environmental stressors (e.g. airports, hog farms) were selected and the most appropriate scale for each of these themes was used in the survey.

The survey was piloted in an Ontario town with a population of less than 1000, located approximately midway between London and Windsor; ethical approval was granted by the University of Waterloo's Office of Research Ethics. The pilot study site was selected because it was representative of the larger county, which has had significant wind turbine development. The locations of the wind turbines within the pilot site were mapped using ArcGIS 9.2 (ESRI, 2012). The Ontario Parcel database (Teranet Incorporated, 2012) was used to determine how many parcels of land there were within a 3km buffer of each wind turbine, which was used as a proxy indicator for the number of houses as well as the number of surveys that needed to be printed.

Surveys were manually distributed in July 2012. First, letters of advanced notice were delivered to residences two weeks prior to survey distribution. These letters included details about the study and contact information for the researchers. For homes that had roadside mailboxes, surveys were placed in mailboxes. For homes that had mail delivered to community lock boxes, advanced notices were delivered to the door. Surveys were delivered using the same distribution process. Surveys were not delivered to businesses or to homes that appeared abandoned. Reminder postcards were sent through the mail three to four weeks after the surveys were distributed, thanking residents who submitted their surveys and encouraging those who had not responded to do so.

Data were analysed in Microsoft Office Excel 2007 (Microsoft Corporation, 2007) and SAS version 9.2 (SAS Institute Incorporated, 2012). Descriptive analyses were conducted, and differences between proportions were tested using the Chi-Square function in Microsoft Excel. Demographics of the pilot sample were compared using a Chi-square test to both the larger town, the Census Metropolitan Area, and the Health Region using information from the 2006 and 2011 Canadian Census (Statistics Canada, 2006a; Statistics Canada, 2006b; Statistics Canada, 2012a; Statistics Canada, 2012b). In calculating distance to wind turbines, midpoints were used in instances where respondents provided ranges.

The SF-12 (a condensed 12-item version of the 36-Item Short Form Health Survey, known as the SF-36) scores were calculated using Health Outcomes Scoring Software 4.5 (Quality Metric Incorporated, 2012). Pittsburgh Sleep Quality Index scores were calculated in SAS using the scoring instructions available from the University of Pittsburgh Sleep Medicine Institute (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). For survey questions that were duplicated from the Canadian Community Health Survey, response frequencies were determined and compared to published population-level frequency data.

3.4. Results

In total, 26 articles were used to determine how health is best assessed when looking at effects of potential or actual environmental stressors. Of these, five which were most relevant to the study are summarised (Table 3-1). Main concepts assessed in these articles were: housing and living environment, sensitivity, exposure, life satisfaction, health, sleep quality, attitudes and perceptions, annoyance, and reaction or coping. Health was the most widely assessed concept, followed by annoyance.

Table 3-1 References and scales identified from the peer-reviewed literature (2002 to 2012) relevant to assessing the health impacts of wind turbines

Article	Variables Examined	Sample Population (n)	Variables assessed and scales used
(Shepherd, Welch, Dirks, & Mathews, 2010)	Noise sensitivity, noise annoyance and health-related quality of life.	Auckland, New Zealand (n = 105)	Health-related quality of life (WHOQOL-BREF); Noise sensitivity (Noise Sensitivity Questionnaire NOISEQ); Susceptibility to noise annoyance
(Schreckenberg, Meis, Kahl, Peschel, & Eikmann, 2010)	Noise sensitivity reflects general environmental sensitivity and is associated with an elevated susceptibility for mental and physical health.	Frankfurt, Germany (n = 190)	Noise sensitivity (Noise Sensitivity Questionnaire NOISEQ); Annoyance due to noise, aircraft noise, and road traffic noise; Residential satisfaction; Health (SF-12); Life satisfaction(German life satisfaction scale); Sleep quality (Pittsburgh Sleep Quality Index PSQI)
(Luginaah, Taylor, Elliott, & Eyles, 2002)	Changes in odour perception and annoyance and self-reported health status attributable to the odour reduction.	Canada (n = 818)	Odour perception and annoyance; Health (SF-36); Attitudes, sources of information, beliefs about health effects
(Shepherd et al., 2011)	Health-related quality of life and proximity to an industrial wind farm in a semirural area.	South Makara Valley, New Zealand (n = 306)	Health-related quality of life (WHOQOL-BREF); Neighbourhood satisfaction; Annoyance; Noise sensitivity
(E. Pedersen, 2011)	Wind turbine noise and potential adverse health effects.	Sweden and the Netherlands (n = 1820)	Response to noise (i.e., annoyance); Diseases or symptoms of impaired health; stress symptoms
(Bakker et al., 2012)	To add knowledge about the impact of wind turbines on sleep and psychological distress of people living in their vicinity.	Netherlands (n = 725)	Annoyance; Sleep disturbance by frequency of sleep disturbance by environmental sound; Psychological distress (General Health Questionnaire)

We developed a survey consisting of six sections, each dealing with one of the five themes identified in the literature review along with a section asking demographic questions (Table 3-2; survey available upon request). In cases where an appropriate, standardized tool was not found, questions addressing the research themes were created by the researchers. The survey was designed to be completed by a random adult (over the age of 18) in the household by asking the adult with the next upcoming birthday to be the respondent. Based on pre-testing, the survey was expected to take approximately 45 minutes to complete.

Table 3-2: Survey themes identified from the peer-reviewed literature (2002 to 2012) relevant to assessing the health impacts of wind turbines

Survey Section/Theme	Aspects	References
1. Attitudes and Perceptions	Questions about energy and RET, risks from RETS, setbacks, and where people obtain health information	(Aatamila et al., 2011; Bullers, 2005; Luginaah et al., 2002; E. Pedersen & Waye, 2004; E. Pedersen, 2007; Schreckenberg et al., 2010)
2. Housing and living environment	Questions about type of residence (i.e., seasonal home), previous residence, number, age and gender of people living in the residence, tenure in community, community life	(Aasvang, Moum, & Engdahl, 2008; Aatamila et al., 2011; Blanes-Vidal et al., 2012; Bodin, Bjork, Ohrstrom, Ardo, & Albin, 2012; de Kluizenaar, Janssen, van Lenthe, Miedema, & Mackenbach, 2009; Dratva et al., 2010; Schreckenberg et al., 2010; Shepherd et al., 2010)
3. Sensitivity, Exposure, Annoyance	Questions about indoor annoyances, time spent at home, distance to RETs	(Aasvang et al., 2008; Aatamila et al., 2011; Bakker et al., 2012; Blanes-Vidal et al., 2012; Bodin et al., 2012; Botteldooren & Lercher, 2004; Brink, Wirth, Schierz, Thomann, & Bauer, 2008; Dratva et al., 2010; Fyhri & Klæboe, 2009; Fyhri & Aasvang, 2010; Herr, zur Nieden, Bödeker, Gieler, & Eikmann, 2003; Ljungberg, 2008; Luginaah et al., 2002; Michaud et al., 2005; Öhrström et al., 2007; E. Pedersen & Waye, 2004; E. Pedersen, 2011; E. Pedersen, 2007; Radon et al., 2004; Radon et al., 2007; Shepherd et al., 2010; Shepherd et al., 2011; Whitfield, 2003)

4. Sleep Quality	Pittsburgh Sleep Quality Index (PQSI), questions about sleep interruption	(Aasvang et al., 2008; Bakker et al., 2012; Bodin et al., 2012; de Kluizenaar et al., 2009; Fyhri & Aasvang, 2010; Öhrström et al., 2007; E. Pedersen & Waye, 2004; E. Pedersen, 2011; E. Pedersen, 2007; Schreckenberg et al., 2010; Shepherd et al., 2010)
5. Life Satisfaction, Health	SF-12v2, symptom list, Satisfaction with life scale (SWLS)	(Aatamila et al., 2011; Bakker et al., 2012; Blanes-Vidal et al., 2012; Bodin et al., 2012; Bullers, 2005; Dratva et al., 2010; Franssen, van Wiechen, Nagelkerke, & Lebret, 2004; Fyhri & Klæboe, 2009; Fyhri & Aasvang, 2010; Herr et al., 2003; Luginaah et al., 2002; Öhrström et al., 2007; E. Pedersen & Waye, 2004; E. Pedersen, 2011; E. Pedersen, 2007; Radon et al., 2004; Radon et al., 2007; Schreckenberg et al., 2010; Shepherd et al., 2010; Shepherd et al., 2011; Villeneuve, Ali, Challacombe, & Hebert, 2009)

During the piloting of the survey, questionnaires were returned by 25.5% of subjects (45/200). There were no significant differences for gender, age, number of people living in the household, or marital status between respondents and the pilot town (Table 3-3). Since data regarding income, education, and proportion of seniors were not available for the study town, county-level data were used; no statistically significant differences between the pilot sample and the county existed for these variables.

Table 3-3: Demographic comparison using Chi-square showing percent of survey respondents per category compared to the study population (except where noted)

	Study Sample (n = 45)	Comparison population (n = 930)[5]	p-value
Sex			
Male	57%	49.7%	0.3
Female	42%	50.3%	
Age			
Median[1]	57	40.5	
Female < 55 years	22%	24%	0.3
Male < 55 years	13%	25%	
Female > 55 years	24%	14%	0.2
Male > 55 years	40%	13%	

Seniors as a proportion[2]	26.7%	15.6%	0.29
Income			
Mean[3]	40-80 000	63 218	
Median[3]	40-80 000	72 731	
Education			
Population aged 25-54 with post-secondary education[4]	55.6%	50.7%	0.15
Marital Status			
Married	71%	42%	0.06
Not married	28%	31%	
Number of people in household			
1-3 people	77%	32%	0.8
4 or more	22%	8%	

[1]Median age for population reflects entire community, study sample was restricted to those aged 18 or over, [2]Seniors considered 65 or older, [3]Chatham-Kent Census Metropolitan Area family income (n = 31,260 families; (Statistics Canada, 2006b)), [4]Chatham-Kent Health Unit (Health Region) (n= 43, 285; (Statistics Canada, 2006a)), [5]Comparison population unless otherwise specified (Statistics Canada, 2012a)

The proportion of missing data is shown for the top ten unanswered questions (Table 3-4). Questions about solar arrays were answered more frequently than questions about biogas, suggesting that the participants knew more about solar arrays or are more aware of the presence of solar arrays in their community. A question about the pseudo-scientific concept of dirty energy and stray voltage was left unanswered by 40% of respondents (n = 18).

Table 3-4: Most frequently unanswered questions from the attitudes and perceptions section of the survey

Survey Question	n (number responded)	% unanswered
Building biogas plants to produce energy is acceptable if they are situated far away from homes	34	24.4%
Wind farms can cause negative health effects in nearby residents	34	24.4%
Solar farms are built where the best available resources are	33	26.7%
Solar farms are a risk to wildlife	32	28.9%

Biogas plants are built where the best available resources are	28	37.8%
Solar farms can cause negative health effects in nearby residents	28	37.8%
Biogas plants are too visually dominant in a rural landscape	28	37.8%
Renewable energy technologies produce dirty energy (stray voltage)	27	40.0%
Biogas plants can cause negative health effects in nearby residents	25	44.4%
Biogas plants are a risk to wildlife	24	46.7%

The average self-reported distances of survey respondents to wind farms, solar farms and biogas plants varied (Table 3-5). Respondents reported living closest to a wind farm and furthest from a biogas plant. The average suggested setback distances for RETs that survey respondents reported (Table 3-5) was similar between RETs.

Table 3-5: Participant self-reported distance to the nearest RET and suggested setback distances

Renewable Energy Technology	Average distance from home (km)	Suggested setback distances (km)
Wind	2.26 (n = 40)[1]	4.83 (n = 28)[4]
Solar	12.67(n = 14)[2]	4.03 (n = 20)[5]
Biogas	29.53 (n = 6)[3]	5.51 (n = 14)[6]

[1]4 responded 'I don't know' and 1 responded 'close', [2]29 responded 'I don't know', 1 responded 'far' and 1 responded 'less than 1km', [3]39 responded 'I don't know', [4]15 responded 'I don't know', 1 responded '1.6-3.2km' and 1 responded '3.2-8km', [5]23 responded 'I don't know', 1 responded 'I don't care' and 1 responded '1.6-3.2km', [6]30 responded 'I don't know', 1 responded '1,600,000km' (did not include in analysis)

For the SF-12 health scale, the average score was 49.3/100 for the Physical Component Summary Scale (PCS) and 47.9/100 for the Mental Component Summary Scale (MCS) score (Table 3-6). For these two scales, higher scores indicate better health and the scale is standardized for a mean score of 50. The average score for the Pittsburgh Sleep Quality Index was 5.7/22. For this scale, a higher score indicates worse sleep. Participants who were very satisfied or satisfied with life made up 60% of the sample (n = 27). Perceived health was very

good or excellent for 51.1% of respondents (n = 23) and perceived mental health was very good or excellent for 55.6% of respondents (n = 25). The average scores for the pilot sample are comparable to those for other, previously published studies (Table 3-6).

Table 3-6: Comparison of health scale scores for study sample to comparable populations health scale scores from other studies

Scale	Source	Value
SF-12 Physical Component Summary Scale (PCS) mean score (/100)	(Radon et al., 2004)	52.4
	(Johnson & Pickard, 2000)	47.6
	(Villeneuve et al., 2009)[1]	45.5-47.2
	Study Sample	49.3
SF-12 Mental Component Summary Scale (MCS) mean score (/100)	(Radon et al., 2004)	49.8
	(Villeneuve et al., 2009) [1]	49.6-51.5
	(Johnson & Pickard, 2000)	51.5
	Study Sample	47.9
Pittsburgh Sleep Quality Index (PSQI) mean score (/22)	(Schreckenberg et al., 2010)	3.4-4.2
	(Nissenbaum et al., 2012) exposed[2] unexposed[3]	7.8 6.0
	Study Sample	5.7
Canadian Community Health Survey, Life satisfied, very satisfied or satisfied, percent of responses	(Statistics Canada, 2012b)[4]	93.5%
	(Statistics Canada, 2012b) [5]	91.8%
	Study Sample	60%
Canadian Community Health Survey, Perceived health very good or excellent, percent of responses	(Statistics Canada, 2012b) [4]	61.3%
	(Statistics Canada, 2012b) [5]	59.3%
	Study Sample	51.1%
Canadian Community Health Survey Perceived mental health very good or excellent, percent of responses	(Statistics Canada, 2012b) [4]	75.2%
	(Statistics Canada, 2012b) [5]	74.2%
	Study Sample	55.6%

[1]Used the SF-36, [2]lived 375-1400m from a wind turbine, [3]lived 3000-6600m from a wind turbine, [4]data for London, Ontario, [5] data for Windsor, Ontario

3.5. Discussion

In this study, we reviewed the literature, and developed and piloted a survey tool to assess the potential health impacts of wind turbines in an adjacent population. This pilot study also assessed

both the survey tool that was created and the distribution method that was used. Although the survey reached a representative sample of the target population, the distribution method was determined to be an inefficient way to deliver and select participants.

The survey was compiled based on a review of literature on the field of environmental stressors and health, and given the modest literature examining wind turbines and health, articles examining noise sensitivity from aircraft as well as odour from industry were an asset in designing the survey (Luginaah et al., 2002; Schreckenberg et al., 2010). The literature review uncovered popular themes that were incorporated into the survey tool, which were: attitudes and perceptions; housing and living environment; sensitivity, exposure, and annoyance; sleep quality; life satisfaction and heath.

The sample appeared to be representative based on variables of income and education. The differences between the general population and study sample based on measures of gender, marital status, age, and number of people living in the household were not statistically significant. The difference between the study sample and general population were statistically significant when comparing marital status, with study participants more likely to be married and the phenomenon that survey respondents are more likely to be married has been described previously (Radler & Ryff, 2010).

The appropriateness of the survey questions was assessed by how frequently the questions were left blank or answered with ‘I don’t know’. Due to a small sample size, conclusions as to the appropriateness of the survey questions could not be made based on frequency distributions with certainty although the distributions of responses were similar to expectations based on the study hypothesis. Questions that were frequently left unanswered focussed on renewable energy technologies (solar and biogas) that were not developed in the community sampled, or asked

respondents for specific numerical answers (e.g. cost to purchase one's home). Participants were asked whether renewable energy produces stray voltage, a complaint that researchers had heard about from stakeholders, but this question was unanswered by a large minority of respondents, indicating that awareness of this possible phenomena is still minimal. There was open space for respondents to provide comments throughout the survey; since no comments were included it was assumed that respondents did not find the questions to be irrelevant or inappropriate.

Participants appeared to have varying exposure to, and knowledge about, the three renewable energy technologies mentioned in the survey, although there was consistency in their responses of how far these should be sited from homes. Although participants reported living an average of 2.26km from a wind turbine and 29.5km from a biogas plant, the suggested distance that these should be located from homes was 5.51km and 4.83km respectively. It may be that this distance is considered outside of one's neighbourhood and is therefore acceptable. This is consistent with the finding that concern over health impacts of wind turbines drops off beyond 5km from the development (Baxter, Morzaria, & Hirsch, 2013).

This study used several standardized scales and questions to assess quality of life. The results from the SF-12 health scale and questions from the Canadian Community Health Survey show that, for a variety of measures, residents living near a wind farm may have lower scores for health than the average Canadian community, but score higher compared to residents living near other environmental stressors like hog farms or an airport. Means and standard deviations found from the scales used (Table 3-6) in the survey were compared to findings from census data and the pertinent literature. For the SF-12 health scale, the mean physical health measure score (49.3) in this study was slightly higher than a study of Albertans in 2000 (47.6; (Johnson & Pickard, 2000)), but lower than a study Germans living near intensive livestock (52.4; (Radon et al.,

2004)), and a study of rural Ontarians living near a hog farm (45.5-47.2; (Villeneuve et al., 2009)). For the mental health/emotional component of the SF-12, the study population had lower scores than the three comparable populations described above (47.9, versus 51.5, 49.8, and 49.6-515.5, respectively). The mean value for the Pittsburgh Sleep Quality Index in this study (5.7) was lower than the residents living near wind turbines and higher than residents living near an airport (Nissenbaum et al., 2012; Schreckenberg et al., 2010). Our sample was less likely to rate themselves as having high levels of life satisfaction, health, and mental health compared to residents of nearby cities (Statistics Canada, 2012b).

There are several limitations to this study. First, the survey assesses aspects of health, quality of life, and sleep through self-reported measures. Given that the modest literature examining health and wind turbines has identified that negative opinions about wind turbines are related to reported impacts on quality of life, the self-reported health measures represented here may not represent actual objective health outcomes. Second, the Ontario Parcel data set map used to approximate the number of homes within the study area did not include complete address data resulting in an underestimation of the size of the target population. A map which includes address data and GPS coordinates of homes would be ideal for researchers who want to mail out surveys and would also benefit researchers who are manually distributing surveys because it would give accurate house locations and counts. Gauging sample representativeness is limited by a lack of community level demographic data. Many of the community-based variables used to check population representativeness come from the county, the larger metropolitan area of which the study community is part. There is potential for survivor bias in studies like this one. Residents severely affected by wind turbines may have moved away before the survey was distributed, and the community may be comprised of residents less impacted by wind turbines.

Those living closest to wind turbines may report fewer health effects because had they felt affected they would have likely moved away. It may be that a dose-response relationship does exist but that survivor bias masks this trend. It has been speculated that non-disclosure agreements exist, meaning that residents who have installed wind turbines have signed a contract with wind turbine companies to ensure that they do not take part in research studies or media interviews. If wind turbines are affecting the health of those who have financial interest in them and also live near them, these residents may be contractually obliged to not share information about these health impacts. After a review of public documents and discussions with residents with wind turbines on their land, nearby neighbours, and a lawyer it was concluded that agreements between wind turbine companies and residents with wind turbines on their land cannot stop people from speaking out against wind farms and their impacts (C. Walker, 2012). Contracts may indicate that homeowners must keep confidential any technical information pertaining to the operation of the wind turbine, and health impacts may be interpreted as part of the operation (C. Walker, 2012). It may be that many people who have signed contracts with wind turbine companies perceive these contracts as 'gag-orders' but these contracts should not prevent someone from suing a wind company if negative health impacts occur (C. Walker, 2012). A counter argument to this idea is that economic benefits from wind turbine development may reduce the likelihood that a person will report reduced quality of life, so those impacted by non-disclosure agreements may not necessarily have much to disclose.

There is limited research in North America on the health impacts of RETs. This research was the first of its kind in Ontario and many lessons were learned in the process. More advertisement and education about the study before survey distribution may increase response rates. Future studies delivering surveys to remote locations or to larger rural populations may want to consider other

delivery and distribution methods to avoid the resource-intensiveness of manual delivery. It may also be worthwhile to contact local government to see if there are GIS maps or address lists that can be used to mail surveys directly to the residences of interest. The sample size did not allow researchers to make conclusions about whether all questions in the survey were necessary but future researchers may want to use a shorter survey to increase response rates. More open-ended qualitative interviews with residents may give insight into non-disclosure agreements which may hinder participation in the study, whether impacted neighbours have moved away, and whether there are impacts of renewable energies that are not captured in the scales used in the survey. Researchers may also want to create another survey for any residents who have moved away from the community of interest because of the wind turbines so that the issue of survivor bias is addressed.

3.6. Conclusions

With the implementation of RETs increasing, understanding possible health impacts is important. To guide this research, methods employed to study other environmental stressors can provide guidance for future studies. We reviewed 26 such studies and identified several variables to assess when looking at environmental stressors and health outcomes: individual factors (i.e., socio-demographic, lifestyle and sensitivity), exposure factors, health-related variables (i.e., health status, sleep quality and life satisfaction), attitudes towards environmental stressors, annoyance and coping. Future RETs and health research should consider using these variables, since surveys that include these variables appear to be robust in assessing health in impacted communities.

3.7. Next steps/synthesis

After a successful pilot study, the group worked to implement a plan to distribute the RETH survey to communities across Ontario. The response rate for the pilot study was typical for a mail survey (20%) and no negative feedback was received. It was hoped that we would be able to address whether there were redundancies or unnecessary questions in the survey, however the sample size was too low in the pilot to properly address this. On the surface it appeared that the survey was appropriate for continued use.

For the RETH survey, the pilot survey remained unchanged and communities were selected. Although there are resources (newspaper articles, websites, applications, environmental assessments) online discussing specific wind farms there was not a single list of all wind farms or a map of all wind turbines. As discussed previously, due to the sparse distribution of wind turbines, knowing the specific location of the turbine is important for determining which nearby residents are of interest to the study. A wind turbine map was created with GIS with information provided by planning departments, developers, and many different departments within the provincial government (Appendix F: **Error! Reference source not found.**, Figure 4). The process is described in a paper published with Dr. Jane Law (Christidis & Law, 2013). After the map was compiled, a sampling framework took shape (Paller et al., 2016). A distribution method using Canada Post AdMail was designed to distribute the survey (Appendix F: Figure 5). The creation of a survey distribution method relied on a thorough literature review and spatial analysis in GIS, and it was decided that homes within 5km of wind turbines were of interest, operationalised as delivery routes that were within a 5km radius of a wind turbine (Paller et al., 2016).

To understand whether or not reported health effects were related to the distance that a person lived from a wind turbine, the wind turbine map and survey data were used to examine possible dose-response relationships between health- and sleep-related variables and distance from the closest wind turbine. Evidence for a dose-response relationship between reported health effects and distance from a wind turbine was not strong (Paller et al., 2015). These findings were not unexpected and were expanded upon through analysis of the perceptions-related questions and reported health outcomes (Chapter 4).

An unexpected outcome of the RETH survey distribution was negative feedback from the communities. To perform outreach in several communities that were dispersed across the province, media releases were distributed and newspaper and radio interviews were given. The 'best practices' for improving survey responses suggested by Dillman were followed within time and budget limitations (Dillman, 2011). In order to increase response rates, a draw was offered for all participants with prizes of an Android tablet or a Canadian Tire gift card of the same value. The tablet offered was from Samsung, a large multinational conglomerate that was involved with renewable energy development in Ontario and that was derided by many people in the communities of interest. This was not considered by the research group or the Office of Research Ethics and the negative response was unexpected. By offering the Samsung tablet as a prize, residents were given the impression that the RETH group had ties to an organization which was unpopular in the community and likely resulted in a loss of trust from potential survey participants. Further, there was speculation that Canadian Tire's board of directors and the University of Waterloo president were silent partners in the study (Ontario Wind Resistance, 2012). Discussion on the anti-wind turbine websites was angry: "Not only would I not buy any Samsung products, I would certainly not accept one for letting them study me to see how much

damage they have done and then try to delve into your past health records to try to find something to blame your health issues on other than the turbines. They are obviously playing on the greed or ignorance of these people."(Ontario Wind Resistance, 2012). Although it is difficult to quantify this, many mailing lists and blogs that informed interested parties about wind turbine issues across Ontario picked up this story and encouraged community members not to participate in the study (Appendix G). Stakeholders were also concerned about the objectivity of all RETH research given that the funding, which was provided by the Council of Ontario Universities, was indirectly coming from the Ontario government - the group encouraging and regulating wind turbine development in the province. This connection seemed to imply to some suspicious parties that the research was designed to support the Ministry of Environment. As one commenter said "The University of Waterloo has certainly devolved from a place of 'higher learning' to just another political 'minion' and 'hired gun' for this Dictatorship!"(Wind Resistance of Melancthon, 2013). Another suggested that the research group would potentially disregard research findings that did not fit the government's mandate or manipulate the research altogether: "Do not throw away or return the survey. Keep the envelope too. Returned unanswered surveys could be filled out by someone else." (Ontario Wind Resistance, 2012). There was also fear that participation in the study would result in legitimization of the study, thereby condoning activities of the government (Appendix G). For example, "WCO strongly recommends that you do not participate in these activities…Clearly the Ontario Government convened and funded research would be viewed as a conflict of interest and it is difficult to imagine that research convened and funded by the Ontario Government can be viewed as unbiased and/or objective. Furthermore without any description of the methodology and stated

purpose of the research it will likely be a waste of time."(Hanna, 2011). The trust of potential participants and interested community members was certainly lost.

The survey was also criticized for its content, another concern that was not raised in the pilot phase. Those who were upset with the survey questions appeared to fundamentally disagree with the concept of the survey in that questions went beyond physical health status and symptoms implying that health effects were psychosomatic. This is not surprising, as those who may report physical symptoms from exposure to wind turbines may feel as if their experience is trivialised when they are asked about risk communication, perceptions, and lifestyle factors. The methodology for designing the survey is described thoroughly in Chapter 3 and inclusion of these types of questions is reasonable and expected in population health research. More thorough pilot studies or focus groups with key stakeholders should be considered in the future for studies examining divisive issues. The actions of the RETH were perceived as insensitive and obtuse.

The response rate for the survey was approximately 8%. Given limitations of distribution methods and the issues discussed above, this low response rate should not be surprising. The distribution method reached most households within 5km of a wind turbine but was also sent to participants who lived more than 5km away from wind turbines, likely too far to grab the interest of community members. The survey likely did not feel relevant to them, which means that the response rate includes people who were not the population of interest. It is difficult to know, when reading blogs and websites and the comments of newspaper articles, how many people were actually upset about wind turbines and whether a small vocal minority were giving a false impression of widespread outrage. High noise sensitivity may occur in 10-15% of the population (Feder et al., 2015; Oiamo, Baxter, Grgicak-Mannion, Xu, & Luginaah, 2015) and it may be that non-respondents comprised the less sensitive portion of residents.

Chapter 4 addresses how residents living in the vicinity of wind farms perceive wind turbines and how these perceptions relate to health. Survey questions examining perceptions of wind turbines, annoyance, and environmental factors were contrasted with reported health status. It was my expectation that wind turbines act as a psychosocial stressor and that health status would not solely be related to distance from a wind turbine, as would be the case if the relationship were purely physical.

4. Understanding the relationship between Psychosocial Factors with Sleep, Mental and Physical Health in Residents near Industrial Wind Turbines

4.1. Overview

Purpose: Industrial wind turbines have been developed in Ontario, Canada and in some cases have been met with opposition and reports of health effects. There is evidence that psychosocial factors play an important role in this issue. This paper explores the relationship between reported health effects and psychosocial factors based on data collected from a cross-sectional survey performed in Ontario communities with wind turbines. Methods: A survey was conducted across eight communities in Ontario, with questions addressing perceptions of wind turbines, risk perceptions, housing and community, sleep, and health. Within this survey, three scales, of which one was developed for this study, were examined through factor analysis. The factor analysis extracted key psychosocial themes and which were contrasted with health outcomes using linear regression analysis. Results: The factor analysis resulted in factors described as 'Health and Environment Concerns', 'Wind Turbine Development Preferences', 'Wind Turbine Sensitivity', 'Industrial Stressors', 'Rural Stressors', and 'Noise Sensitivity'. When these factors were compared to health outcomes it was found that health, measured through self-reported mental health, physical health, and sleep, is related to perceptions of wind turbine development. Conclusions: The potential for perceptions to mediate the relationship between wind turbine exposure and reported health effects is an important addition to environmental health theory.

Keywords: emerging environmental health risk, renewable energy, psychosocial health, factor analysis, risk perceptions

4.2. Introduction

The development of wind turbines for grid-connected electricity generation is a recent occurrence in the Canadian province of Ontario to where wind energy is projected to produce

10% of the province's energy by 2030 (Ministry of Energy, 2010). This development has met opposition and reports of health effects in local residents from exposure to the wind turbines while in operation (Hill & Knott, 2010). However, at a population-level, traditional energy sources (coal, oil, gas, nuclear) have greater established health impacts, measured as years of life lost and restricted activity days, compared to wind energy (Krewitt, Hurley, Trukenmuller, & Friedrich, 1998). The health effects that may result from exposure to wind turbines are modest when contextualized on a population level and when compared to other energy generation sources.

The following symptoms – sleep disturbance, headaches, difficulty concentrating, irritability and fatigue – have been referred to as 'wind turbine syndrome' and are hypothesized to result from the low frequency sounds that wind turbines generate (Pierpont, 2009). Since wind farms are a new source of environmental noise, the impact of wind turbine noise on health and well-being has not yet been well-established (E. Pedersen et al., 2010). Although a physical stressor such as low frequency noise causing health effects is a feasible mechanism to consider, other possible psychosocial stressors related to wind turbine development should also be considered.

There is evidence that psychosocial factors related to wind turbines impact perceptions and reported effects. Wind turbine noise is perceived by some as annoying, and people pay attention to more annoying noises for a longer period of time (Waye & Ohrstrom, 2002). Reported annoyance is higher when the wind turbines are more visible (flat terrain compared to rocky or hilly areas) and the visual impact of a wind turbine mediates how annoying the sound is perceived to be (E. Pedersen & Waye, 2004; E. Pedersen & Larsman, 2008; E. Pedersen et al., 2008). Reported annoyance from wind turbines is minimized by economic benefits to local residents and loud road traffic (C. S. Pedersen et al., 2008; E. Pedersen et al., 2010).

Environmental stressors and resultant health impacts are often difficult to measure and diagnose, with abstract associations and multiple and non-specific health outcomes reported from those who are impacted (Neubauer et al., 2007; Siegrist et al., 2005).

This paper explores the relationship between reported health effects and psychosocial factors based on data collected from a cross-sectional survey performed in Ontario communities with wind turbines. A scale that was developed for this survey, along with two other scales examining psychosocial factors, were examined through Factor Analysis to extract key themes and determine underlying relationships between survey items. Exploratory Factor Analysis was used to examine psychosocial questions from the survey in order to extract relevant themes in the form of factors. Factor Analysis is an examination of correlations between survey items that results in the compilation of groupings, or factors, populated by items that are strongly correlated with each other and weakly correlated with other survey items. Exploratory Factor Analysis is appropriate in this application as it is a widely used data reduction technique that provides an analysis of the interrelatedness of survey items (Cleff, 2014; Williams, Brown, & Onsman, 2012). The factors generated represent compiled groupings of related survey items that have utility in creating meaningful constructs (Cleff, 2014; Williams et al., 2012). These themes were contrasted with self-reported health effects through regression analysis to shed light on a psychosocial health issue that has not yet been explored, and advances theory related to the interrelationships between wind turbine development, health, and perceptions. Further, by developing a scale that examines perceptions of wind turbines and analysing it through Factor Analysis, key themes worthy of consideration for future research are established.

4.3. Methods

4.3.1. Data Collection

As described previously, a survey of 473 residents living near eight different wind farms in Ontario, Canada was performed (Paller et al., 2015) to capture the unique experiences of residents in communities with renewable energy technologies. Research approval was granted by the University of Waterloo's Office of Research Ethics. The survey incorporated validated scales and a number of questions to explore psychosocial concepts that were unique to the context of the implementation of wind energy in the province, which are described below.

4.3.1.1. Measures of Health and Wellbeing

The Satisfaction with Life Scale (SWLS) is a global measure of life satisfaction, measuring cognitive judgments of satisfaction with one's life (Diener, Emmons, Larsen, & Griffin, 1985; Pavot & Diener, 1993). The scores from the five questions were totaled, with a maximum score of 35, and were treated as a continuous variable. Higher scores indicate higher life satisfaction.

The SF-12v2 Health Survey (Ware, Kosinski, & Keller, 1998), a condensed version of the SF-36, was used to measure physical and mental health (Villeneuve et al., 2009), using 12 questions. The QualityMetric's Health Outcomes Scoring Software 4.5 provides output as a Physical Component Score (PCS) and Mental Component Score (MCS), with higher scores indicating better health.

Information about sleep quality was collected using the Pittsburgh Sleep Quality Index (PSQI), which assesses sleep quality and disturbance over a one-month time period (Buysse et al., 1989). The PSQI uses 19 self-rated questions resulting in one global score, with higher scores indicating poorer quality sleep.

4.3.1.2. Measures of Psychosocial Factors

A series of statements for participants to rate was developed to examine perceptions of wind turbines and renewable energy development in Ontario. These statements are based on themes that were found through a review of: peer-reviewed literature on wind turbines and environmental stressors, media reports, anecdotal information, and a policy review. The statements, referred to as the 'Perceptions Scale' (Table 4-1), inquired about how well the statements described a participant's view of renewable energy technologies in Ontario and statements were scored on a 5-point Likert scale.

The Project WINDFARM-perception Study used in the Netherlands was considered and adapted for use in the survey (Van Den Berg, 2008). The study examined residents living within 2.5km of a wind turbine and had questions related to perceptions of residents' living environment (Van Den Berg, 2005). Participants were to rate the statements as they describe life in their community over the past four weeks (Table 4-2) on a 5-point Likert scale to indicate agreement or disagreement referred to as the 'Living Environment Scale'.

A number of items from Van Den Berg (2005) as well as those developed by the research team constitute the 'Annoyance Scale' (Table 4-3). Annoyance was defined as things that the participants notice and are annoyed by when they are inside their home. The level of annoyance was indicated on a 5-point Likert scale with 'N/A, not exposed' as an option.

4.3.2. Data Analysis

Completed surveys were returned to the University of Waterloo by study participants using Canada Post's Business Reply Mail Service. All descriptive analyses and statistical analysis were performed using SAS Software, Version 9.22 for the Windows 7® operating system.

4.3.3. Sample comparison

The sample's demographic characteristics (percent male, percent married, and percent with post-secondary education) were compared to Census Subdivision data for each county (using 2011 Canadian Census data, and when unavailable, Canadian Census data from 2006) using a two-tailed t-test when data were available (Paller et al., 2015).

4.3.4. Factor Analysis and Regression

Factor Analyses were run for each of the three sets of questions that examined psychosocial factors: the Perceptions Scale, the Living Environment Scale, and the Annoyance Scale. These analyses were done separately since a combined analysis of all three scales resulted in items from the same scales being grouped together, masking relationships between items within the scales. Factors were extracted with the Multivariate Factor Analysis option in SAS using the principal component analysis (PCA) factoring method and an orthogonal varimax rotation method. The factor analytical method used in this study was a synthesis of procedures from peer-reviewed literature, as there is no universal agreement regarding methods for Factor Analysis (Burkhardt, Loxton, Kagee, & Ollendick, 2012; Coussement, Demoulin, & Charry, 2011; Gonzalez, Nelson, Gutkin, & Shwery, 2004). The outputs of the Factor Analyses are 'factors' and corresponding 'score correlations' that indicate the correlation between each survey question and each factor.

The Factor Analyses results were assessed for significance using three standard criteria. First, factors with eigenvalues below 1 were discarded. An eigenvalue is a ratio indicating the variance represented by the factor compared to the variance represented by the items. Eigenvalues above one indicate that the factor represents more of the item variance than the individual items, and this implies that the constructed factor taps into a shared association between these items. The

retention of factors with eigenvalues above one is described as following the Kaiser Retention criteria (Cleff, 2014). Similarly, eigenvalues below one were not retained because this value indicates that the factor explains less variance than its component parts (Cleff, 2014).

Second, the score correlations for each item were assessed individually using +/- 0.30 as a threshold for significance. For each item, or survey question, a score correlation representing how strongly the item correlates to each factor was generated. Items that did not weigh significantly on any of the factors (no correlations greater than 0.30, or between -0.30 and 0) were discarded. These lower scores indicate that less than 30% of the variance within the data is explained by the factor (Williams et al., 2012). Items that met the +/-0.30 score correlation threshold on multiple factors were also excluded. Although these items may be relevant in other types of analysis of the survey, Factor Analysis aims to extract unique interrelated factors and exclusion of items that weigh on multiple factors ensures that the factors are comprised of unique items. Items that correlate on multiple factors by definition do not uniquely relate to a factor, and these have limited value in constructing factors (Gonzalez et al., 2004). After these criteria were applied, all remaining items were correlated uniquely to only one factor and this correlation met the score correlation threshold.

Third, before linear regression analysis, factors with three items or fewer were discarded. This step may lead to the exclusion of survey items that may otherwise be significantly related to the independent variables of interest, however, the goal of a Factor Analysis is to create robust factors that represent meaningful constructs. Factors with less than three items cannot be used to create meaningful constructs or summarize survey items of interest. The practice of excluding factors with too few items to be considered a meaningful construct is consistent with practice (Williams et al., 2012). The factors meeting these three aforementioned study criteria were then

used to perform regression analysis. Linear regression models were run in SAS comparing each of the factors to each of the four different health-related response variables (satisfaction with life (SWLS), sleep quality (PSQI), mental health (MCS), and physical health (PCS)) and controlling for age and gender.

4.4. Results

4.4.1. Sample Description

The response rate was 9.70% (473/4875) and the average respondent was 55 years old and married (n = 344; 70.6%). The most frequently reported household income range and education level were $40-80,000 (n = 110; 23.3%) and college diploma or university degree (n = 231; 48.8%). Survey respondents were selected based on close proximity to wind turbines; the average self-reported distance to a wind turbine was 2835m and approximately one-quarter of the respondents lived less than 1000m from a wind turbine. A comparison between the sample and comparison population is described in greater detail elsewhere (Paller et al., 2015). The difference between the study sample and comparison population was statistically significant when comparing post-secondary education status ($p < 0.05$) and marital status ($p < 0.05$).

4.4.2. Survey Results

4.4.2.1. Health

Most survey respondents (65.91%) were poor sleepers (i.e., high PSQI scores, average = 5.88). A total of 43.94% of survey respondents had below average physical health status (i.e., low PCS score, mean = 48.91) and 16.41% were at risk for depression (i.e., low MCS score, mean = 51.74). The mean satisfaction with life score was 24.11 and 30.05% of respondents were not satisfied with their life (i.e., low satisfaction with life (SWLS) score).

4.4.2.2. Perceptions

For the Perceptions Scale participants agreed most frequently with 'Ontarians have an obligation to reduce energy consumption' (n = 395; 83.5%) and 'Ontarians have an obligation to generate cleaner electricity' (n = 392; 82.9%). The lowest agreement was for 'Renewable energy technologies produce dirty energy (stray voltage)' (n = 111; 23.5%).

When responding to questions from the Annoyance Scale, respondents most frequently reported being annoyed by flies and/or gnats (n = 116; 24.5%) and visible wind turbines (n = 114; 24.1%). Respondents reported being least annoyed (among those who were exposed) by the sound from agricultural machinery (n = 365; 77.2%).

For the Living Environment Scale questions, agreement was highest for the following statements: 'I like to personalize my dwelling.' (n = 418; 88.4%) and 'The natural landscape around my house is relaxing.' (n = 406; 85.8%). Agreement was lowest with the statement 'It is not very important what my community looks like, as long as it is functional.' (n = 365; 77.2%).

4.4.3. Factor Analyses

The first Factor Analysis performed was for the Perceptions Scale (Table 4-1). Factor 1, described as 'health and environment concerns', consisted of four items. Factor 2, described as 'wind turbine development preferences' consisted of three items, but was not significantly related to the health outcomes of interest. Factor 3 consisted of two items and was not retained for regression analysis.

Table 4-1: Factor Analysis for Perceptions Scale

	Score correlations		
Factors and survey items	Factor 1	Factor 2	Factor 3
Factor 1 – Health and Environment Concerns			
Wind farms should only be located in communities that want this type of development.[1]	**0.67**	0.30	-0.03

Wind farms are a risk to wildlife.	**0.81**	-0.19	-0.08
Wind farms can cause negative health effects in nearby residents.	**0.90**	-0.17	-0.06
Wind farms are too visually dominant in a rural landscape.	**0.88**	-0.15	-0.13
Renewable energy technologies produce dirty energy (stray voltage).	**0.80**	-0.14	-0.12
Factor 2 – Wind Turbine Development Preferences[2]			
Building wind farms to produce energy is acceptable if they are situated far away from homes.	-0.23	**0.52**	0.14
Wind farms should be owned by people in the community.	-0.04	**0.76**	0.14
A community that is producing its own renewable energy should receive electricity at a discount.	0.04	**0.74**	-0.05
Factor 3[1]			
Ontarians have an obligation to reduce energy consumption.[1]	-0.10	0.14	**0.87**
Ontarians have an obligation to generate cleaner electricity.[1]	-0.13	0.10	**0.89**
Variables excluded due to saturation with multiple factors			
Wind farms are built where the best available resources are.[2]	-0.72	0.40	0.16
I am interested in renewable energy as a new source of income.	-0.34	0.52	0.16

[1]Factor excluded from regression analysis because of inadequate factor construction,
[2]Factor was not significantly related to health outcomes of interests in the subsequent regression analysis

The Annoyance Scale produced four factors (Table 4-2). Factor 1, described as 'wind turbine sensitivity' consisted of four items. Two other factors, 'industrial stress' and 'rural stressors' were found but were not significantly related to the health outcomes of interest. Factor 4 was not retained for the regression analysis.

Table 4-2: Factor Analysis for Annoyance Scale

	Score correlations			
Factors and survey items	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1 – Wind Turbine Sensitivity				
Visible wind turbines	**0.80**	0.17	0.07	0.16
Flicker from wind turbines	**0.88**	0.20	0.08	0.03
Sound from wind turbines	**0.87**	0.22	0.06	0.05
Vibrations from wind turbines	**0.87**	0.20	0.13	0.00
Factor 2 – Industrial Stressors[2]				
Odour from industries	0.13	**0.64**	0.23	-0.01
Vibrations from a railway	0.27	**0.81**	0.03	0.04
Sound from railways	0.18	**0.81**	0.00	0.10
Visible factories	0.19	**0.76**	0.02	0.14

Factor 3 – Rural Stressors[2]				
Odour from manure	0.14	0.07	**0.79**	0.08
Flies and/or gnats	0.04	0.06	**0.81**	-0.11
Sound from agricultural machinery	0.22	-0.05	**0.64**	0.19
Sound from airplanes	-0.09	0.30	**0.47**	0.25
Factor 4[1]				
Sound from road traffic	0.02	0.05	0.15	**0.79**
Visible busy road	0.23	0.16	0.01	**0.73**
Variables excluded due to saturation with multiple factors				
Visible power lines/pylons	0.46	0.12	0.23	0.33
Visible solar panels	0.43	0.42	0.02	0.23

[1]Factor excluded from regression analysis because of inadequate factor construction,
[2]Factor was not significantly related to health outcomes of interests in the subsequent regression analysis

The Living Environment Scale consisted of five factors (Table 4-3). Factor 1 can be described as 'noise sensitivity'. Factors 2, 3, 4 and 5 were not retained for the regression analysis.

Table 4-3: Factor Analysis for Living Environment Scale

	Score correlations				
Factors and survey items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1 – Noise Sensitivity					
When outside on a calm summer morning, I can hear only birds singing and other nature sounds.[1]	**-0.74**	0.06	0.14	0.15	-0.02
The natural landscape around my house is relaxing.[1]	**-0.62**	-0.06	0.28	0.12	0.09
It is never really quiet in the area.	**0.78**	0.02	0.07	0.16	0.01
Factor 2[1]					
I feel a sense of community with people living in this area.	0.02	**0.77**	0.08	0.04	0.06
I have many friends in the community that I socialize with.	0.00	**0.83**	-0.11	-0.01	-0.04
Factor 3[1]					
I spend a lot of time at home if possible.	-0.14	-0.11	**0.66**	0.05	-0.33
I am concerned about keeping the garden/backyard tidy.	0.00	-0.03	**0.56**	-0.27	0.13
Factor 4[1]					
It is not very important what my community looks like, as long as it is functional.[2]	-0.11	-0.15	-0.18	**0.70**	-0.07

The area where I live is suitable for economic growth.[2]	0.08	0.30	0.04	**0.60**	0.20
Factor 5[1]					
Sound from agricultural machinery is a natural part of life in my community.	-0.05	-0.18	-0.10	-0.03	**0.78**
I have renovated major parts of my dwelling since I moved in.	0.02	0.19	0.12	0.09	**0.55**
Variables excluded due to saturation with multiple factors					
I like to personalize my dwelling.	-0.15	0.32	0.52	0.08	0.31
Background sounds from road traffic are almost always present outdoors near my dwelling.[1]	0.56	0.00	0.36	0.44	0.08

[1]Factor excluded from regression analysis because of inadequate factor construction,
[2]Factor was not significantly related to health outcomes of interests in the subsequent regression analysis

4.4.4. Linear Regression

The linear regression analysis found significant relationships among psychosocial factors and health outcomes (Table 4-4). First, 'health and environment concerns' was negatively related to mental health and physical health, and positively related to sleep quality scores (higher values indicate worse sleep). The 'wind turbine sensitivity' and factor was positively related to physical health. Both the 'wind turbine sensitivity' and 'noise sensitivity' were negatively related to sleep quality scores. All other factors retained from the factor analysis were not significantly related to the health measures of interest.

Table 4-4: Parameter estimates from a linear regression analysis comparing perception factors to health measures

	Health measures (parameter estimates with p-values)			
Perception factors	Sleep Quality[1]	Satisfaction with Life[2]	Mental Health[3]	Physical Health[3]
Health and Environment Concerns	**0.35 (0.02)**	-0.69 (0.22)	**-2.00 (0.01)**	**-1.56 (0.03)**
Wind Turbine Development Preferences	0.12 (0.37)	-0.21 (0.64)	0.53 (0.33)	0.54 (0.34)
Wind Turbine Sensitivity	**-0.27 (0.02)**	0.21 (0.63)	0.19 (0.70)	**1.53 (0.01)**
Industrial Stressors	0.09 (0.42)	-0.01 (0.98)	0.29 (0.54)	0.26 (0.60)
Rural Stressors	-0.17 (0.13)	-0.21 (0.58)	-0.29 (0.53)	0.63 (0.20)
Noise Sensitivity	**-0.29 (0.01)**	0.58 (0.14)	0.81 (0.08)	0.84 (0.09)

[1]Sleep quality measured with the Pittsburgh Sleep Quality Index. [2]Satisfaction with Life measured with the Satisfaction With Life Scale. [3]Mental Health and Physical Health measured with the SF-12.

4.5. Discussion

The sleep quality in the sample, as measured by the PSQI (mean score 5.88) was better than a population living near wind turbines (7.80) (Nissenbaum et al., 2012), but worse than a population living near an airport (3.40-4.20) (Schreckenberg et al., 2010). These results indicate that wind turbines may impact sleep but the impact is lesser than an established environmental stressor such as an airport. The mean physical health score (PCS = 48.91) was lower than a population living near intensive livestock (52.40) (Radon et al., 2004) and higher than a study of Albertans (47.60) (Johnson & Pickard, 2000) and population living near a hog farm (45.50-47.20) (Villeneuve et al., 2009). The mean mental health score (MCS = 51.74) of the sample was higher than the three comparable populations described above (51.50 (Johnson & Pickard, 2000), 49.60-51.50 (Villeneuve et al., 2009), 49.80 (Radon et al., 2004)). The scores from both of these components are lower than samples living near environmental stressors and higher than samples of representative Canadians, indicating that wind turbines may act as a mild environmental stressor. Life satisfaction in the sample (24.11) was higher than a sample of Canadians recovering from spinal cord injury (20.80) (Tonack et al., 2008) and comparable to scores of older adults with chronic diseases in Vancouver region (24.77) (Anaby et al., 2011). Given that the sample from this study comprises an older segment of the population, it appears that life satisfaction is comparable to other populations in Canada who do not live near wind turbines.

The Perceptions Scale used questions developed by study researchers but comparisons with similar studies in Ontario are possible. The study sample showed similar support for reducing

energy consumption and generating cleaner electricity, compared to similar communities in Ontario (C. Walker, Baxter, & Ouellette, 2014). The sample was also similar to other Ontario communities in agreeing with the idea that there should be discounted electricity rates for the communities that produce renewable energy (C. Walker et al., 2014). The study sample largely disagreed that wind farms can cause health effects in nearby residents and a study of a similar population in Ontario found that 45.0% of respondents were worried about the potential for health effects resulting from wind turbine exposure (Baxter et al., 2013).

The Project WINDFARM-perception Study survey results were not published as response frequency values and could not be compared to the Annoyance and Living Environment Scale responses from the current study. The sample did find wind turbines annoying, but did not find noise from machinery, airplanes or road traffic to be annoying which is consistent with findings from the Netherlands (E. Pedersen et al., 2009).

Factor Analyses were performed on three scales, reducing 41 self-reported survey items to five factors representing uniquely defined, relevant constructs. Some items from the Perceptions Scale and the Living Environment Scale did not meet the inclusion threshold of 0.30 for item scores. All items from the Annoyance Scale met the inclusion threshold of 0.30. After items that were saturated or did not meet thresholds were excluded, some factors were not worthy of inclusion in the regression because they had inadequate numbers of items loaded on them after items were excluded. The resulting factors were constructs comprised of items that were uniquely and significantly correlated to each other.

Linear regression analyses were performed on the remaining factors and each factor was contrasted with four different measures of health – life satisfaction, sleep quality, mental health,

and physical health. The Satisfaction with Life Scale was compared to the four factors and no relationships were found.

Sleep was related to ‘health and environment concerns’, ‘wind turbine sensitivity’, and ‘noise sensitivity’. As concerns with impacts of wind turbines on health and environment increase, sleep quality appears to decrease. As annoyance with wind turbines and sensitivity to noise increases, it appears that sleep quality increases as well. This is an unexpected finding that is worth addressing in future work. Annoyance with wind turbines has been associated with poor sleep quality (Onakpoya, O'Sullivan, Thompson, & Heneghan, 2015; Schmidt & Klokker, 2014) but a direct relationship between wind turbine noise and sleep is tenuous (Michaud et al., 2016). Health Canada found that disturbed sleep was not related to wind turbine noise exposure but was related to annoyance (Michaud, Feder, Keith, Voicescu, Marro, Than, Guay, Denning, Bower, & Lavigne, 2016), supporting the findings presented here that mediating psychosocial factors may influence the relationship between wind turbine noise exposure and sleep quality (Michaud et al., 2016).

Mental health (as measured by the SF-12 mental health component score) was negatively related to ‘health and environment concerns’ and positively related to ‘community capital’. This means that better mental health is related to lower concerns of the impact of wind turbines on health and environment. This is a novel finding and has not yet been described in the literature although there is evidence that personality characteristics increase susceptibility to the impacts of environmental stressors (Cakmak & Dales, 2016). The finding that better mental health is related to greater community capital has been found consistently in the social health literature but not in reference to communities with wind turbines (Berry & Welsh, 2010; Fujiwara & Kawachi, 2008; Ziersch, Baum, MacDougall, & Putland, 2005). Stress and decreased quality of life were related

to annoyance (Michaud, Keith et al., 2016) but not exposure to wind turbine noise (Michaud, Feder, Keith, Voicescu, Marro, Than, Guay, Denning, Bower, & Villeneuve, 2016), which further support the importance of mediating factors in the relationship between wind turbine exposure and poor mental health outcomes.

Physical health, measured as the physical component score of the SF-12, was negatively related to 'health and environment concerns', indicating that better physical health is related to fewer concerns about the impact of wind turbines on health and environment. This finding is also novel, and has not yet been reported in similar studies. The 'wind turbine sensitivity' factor was positively related to physical health indicating that better physical health is related to greater annoyance with wind turbine characteristics. Future research should explore this relationship.

The results of the Factor Analysis of the Perceptions Scale can be used to inform efforts to measure psychosocial aspects of wind turbine perceptions. There is potential utility for this scale to measure the concerns of the personal impact of wind turbines on nearby residents. This Factor Analysis is the first step towards the construction of a valid scale to measure the perceived health, environmental, and financial impacts of wind turbines on nearby residents. There is potential for these questions to be adapted for use in exploring perceptions of other environmental stressors or unwanted land uses.

Similar research in Ontario has indicated that psychosocial factors are an important aspect of the relationship between wind turbines and community health and annoyance. Annoyance was found to be related to property ownership, household complaints, perceived stress, self-reported sleep disturbance, annoyance with other aspects of wind turbines, and typically self-reported illnesses such as migraines, tinnitus, dizziness, and chronic pain (Michaud et al., 2016). Further support for this concept can be found in evidence for the lack of a direct relationship between wind

turbine noise exposure and quality of life: despite varying exposure to noise from wind turbine, there is a consistent prevalence of sleep disturbance, illnesses, and chronic diseases in communities with wind turbines (Michaud et al., 2016).

There are limitations worth considering when interpreting these findings. First, the response rate to the survey that the analysis is based on was low (9.70%) although the sample size was adequate for a robust Factor Analysis (n = 473). Selection bias is a concern with a low response rate and it is possible that the population of interest is not well represented by the sample. The demographic comparison included in this paper indicates that basic demographics of this sample differ from the population in terms of education status and marital status. Because of these differences, and the low response rate, it is possible that the attitudes and experiences of respondents compared to non-respondents may be significantly different. The profile of the respondents of the survey is less clear given the proposed boycott of the survey. Whereas it could be expected under regular circumstances that opponents, or those with the strongest opinion about wind turbines, would comprise the sample, the proposed boycott of the survey by opponents suggests that respondents are likely not opponents. Generally, one would expect that the silent majority who are not impacted by wind turbines would not choose to respond to the survey either. Logically, neither of these groups would be interested in the study, which would explain the low response rate but does not explain which types of community members did choose to participate. It may be that opponents who were less extreme and therefore less swayed by the opinions of opposition groups chose to participate. Factor Analysis interpretation can be somewhat subjective but thoughtful decision-making and reliance on best-practices from the literature can ensure that accountable and rational criteria have been implemented. Although this was the case, the results of the Factor Analysis and subsequent regression should not be

overstated – this was an exploratory analysis of data and results reflect the interpretation of data by the researcher. Although it appears that perception factors are related to health outcomes there is not enough information to indicate which one came first temporally, or whether this is a causal or correlational relationship.

These findings indicate that there are relationships between psychosocial factors, perceptions, and opinions of wind turbines and self-reported health. The implication of this research for theory is that the relationship between wind turbine development and health effects may be mediated by perceptions of wind turbines.

4.6. Conclusion

This study was the first of its kind to establish a relationship between mental and physical health status and concerns about the impact of wind turbines on health and environment. These results indicate that self-reported health is lower in community members who report concerns over the impact of wind turbines on health. Sleep was significantly related to three different wind perceptions factors, indicating that sleep outcomes are an important outcome of wind turbine perceptions. The potential for perceptions to mediate the relationship between wind turbine exposure and reported health effects is an important addition to environmental health theory.

4.7. Next steps/synthesis

The factor analysis indicates that perceptions of wind turbines are related to reported health effects. The results of this paper along with the results of the literature review presented in Chapter 2 indicate that wind turbine opposition is not solely a result of reported health effects in a community. Emails, blog posts, and online comments from opponents described opposition as a result of a variety of concerns. A deeper consideration of this theme and interaction with communities with wind turbines was required.

The REA does not rely on typical planning or decision-making processes and it is worth considering how this process may have influenced opinions of wind turbine developments and, by extension, perceptions and reported health outcomes. When the REA was introduced, former Ontario Premier Dalton McGuinty stated that the new policy would put an end to NIMBYism regarding wind turbine development and prevent future efforts to block wind turbine development. This approval process enabled rapid and large-scale development of renewable energy infrastructure by relying on a top-down decision-making process which removed local control over development. The policy enables inequality between community members (those who host wind turbines get financial benefit yet neighbours do not), and among communities (host communities do not necessarily receive benefits from the development or benefits are distributed unequally). The REA did spur development and in some cases reduced burden placed on planners in counties who were not equipped to make decisions about siting this type of infrastructure.

Issues of social and environmental justice have been discussed within the context of wind turbine development but are often simplistic – there are many levels of inequality and justice to consider. If development of wind turbines under the REA is unjust, it is worth considering that the uptake of renewables in Canada is a globally responsible choice that addresses issues of climate justice. Decisions are not made in a vacuum and a broad understanding of context is crucial in this topic. Whether planning decision-making processes and outcomes are just is an important factor to consider, given that there are multiple levels of inequality that surround energy decisions. Despite a prevailing participatory planning paradigm used for other types of development, these processes may not be appropriate for electricity infrastructure planning. Participatory decision-making does not appear to be the best option for the technical decision-making that is required in

planning electricity generation facilities. Further, there is evidence that participatory processes tend to result in decisions that appease higher-capital residents; participatory practices do not necessarily result in just outcomes (Christidis, 2016).

In the case of wind turbines, perceived risks to health are a predictor of community support for wind turbines (Baxter et al., 2013). Perceived risks regarding wind turbines have proliferated in the province of Ontario in community newspapers by focusing on aspects of dread, involuntary exposure, inequitable distribution, and the idea that wind turbines are poorly understood by science (Deignan, Harvey, & Hoffman-Goetz, 2013). The communication of perceived risks of wind turbines by community newspapers in Ontario reflects the highly political nature of wind turbine and health research, in this case perceived inequalities between rural and urban Ontario are a possible source (Deignan et al., 2013). These politics are not limited to information in the media; there are politically charged peer-reviewed articles being published in academic journals as well (Krogh et al., 2011; Krogh, 2011; McMurtry, 2011). There is a group in Australia who has pushed for recognition of the concept of "vibroacoustic disease", proliferated by self-citation and through published papers that are not considered strong epidemiological research by some, and this research is being used by opponents to WTs (Chapman & St George, 2013). This is also the case with Nina Pierpont's work and the creation of the term "Wind Turbine Syndrome" to refer to symptoms related to wind turbine exposure, which is then legitimized by articles written by known wind turbine opponents (Krogh et al., 2011; McMurtry, 2011; Pierpont, 2009).

Perceived risks related to wind turbines are consistent with the perceived risk factors of other environmental stressors like EMF, power lines, cell phone radio frequencies, and cell phone base towers (Deignan et al., 2013; Siegrist et al., 2005). Further, Baxter found that control communities perceived higher risks than case communities living with wind turbines (Baxter et

al., 2013). These two sets of findings align well with the Social Amplification of Risk theory (Kasperson et al., 1988). This theory seeks to explore why there are public reactions to risk that are incompatible with the risks as they are assessed by technical experts. The theory suggests that risks as they are perceived by society are assessed and, through a variety of psychological, social, and cultural processes, can be amplified or attenuated. The amplification results in higher concern over that risk and the attenuation results in lower concern. Attenuation is likely to occur with well-documented hazards that are faced in everyday life with the attenuation of the perceived risk being a necessary coping mechanism. There is evidence that concerns over risk decrease over time as wind turbines or other infrastructure are developed and prove to be safely operating (Baxter et al., 2013), which is consistent with other findings that perceived risks are higher in control communities but this goodwill may reduce over time if expansion is suggested and a community feels it has already done its part by hosting a facility already (Baxter et al., 2013). Conversely, it appears that social amplification of risk may have occurred in the perceived risks related to wind turbines in Ontario – a novel environmental exposure. The media analysis performed in Ontario infers that risk amplification may have occurred as a result of local media exacerbating fear of wind turbines (Deignan et al., 2013; Songsore, 2015) although amplification/attenuation can also occur through social organizations, opinion leaders, personal networks, or public agencies (Kasperson et al., 1988). Risk and uncertainty can increase among residents when there is a lack of clarity or information coming from experts (Eyles, Taylor, Baxter, Sider, & Willms, 1993). Secondary impacts of these socially amplified risks are theorized by Kasperson and align with impacts seen in Ontario (and elsewhere), for example: enduring mental perceptions and attitudes, local impacts on residential property values, political

and social pressure, social disorder, changes in risk monitoring, and repercussions on other technologies or on social institutions (Kasperson et al., 1988).

According to Shepherd et al. (2011), wind turbine farms can negatively impact health-related quality of life by impacting sleep quality and annoyance, leading to a chronic stress response resulting in diminished physical and environmental quality of life. However, reports of health effects in communities appear to go well beyond these findings, which indicates that the concept of perceived risk is an important one when discussing this topic. Hazards themselves are "modern mythological creatures" that can result in ambiguity and dubious interpretations (Beck, 1992). Given that wind turbine opposition appears to be rooted in risk perceptions, a paradigm for decision-making with possible risks or development that is perceived to be risky is necessary. The precautionary principle tries to assess risks systematically and rationally. There are six common elements in assessing risks according to the principle: scientific certainty, scientific plausibility, causal relationship possibility, morally unacceptable harm, feasible intervention, and ongoing monitoring (Martuzzi, 2007). The precautionary principle is not without flaws or critics. Deciding what is an acceptable risk based on the precautionary principle is not an objective decision and the level of risk that is acceptable is highly dependent on socio-cultural values (Jensen, 2002). Although predicted risks can be quantified using a variety of factors, these are still probabilistic models thus making decisions about acceptable risks and thresholds somewhat arbitrary (Jensen, 2002; Starr, 2003). Fischhoff attempts to create a similar framework for decision making, stating that we must consider costs, benefits, and risks for society and individuals and ensure that individual members of the public are not bearing additional risk to life and health (Fischhoff, 1983). Further, societal risks should not be greater than competing technologies or other societal risks (although comparison is very difficult) (Fischhoff, 1983).

This paradigm is not without weaknesses given that the ideal of the greatest good for the greatest number is an inadequate philosophy when considering that people who bear the risks are not necessarily the same ones who benefit, leading to inequalities in outcomes (Fischhoff, 1983). It is also not fair to assume that society is comfortable with the current risks faced in daily life or that citizens have had a choice in the risks that they are exposed to, as some risks began to be imposed at a time when perceived risks were different from current views (Fischhoff, 1983). Stakeholders want to know what the costs and benefits of an exposure are and decision-making processes will suffer from issues who with who felt represented but ignored or misrepresented, those who were not represented, and those who lacked resources to engage (Fischhoff, 1983).

There is potential that progress in new technologies will be stopped if there appears to be an intrusion on health, food, or the environment and this may deprive the public of potentially beneficial options (Starr, 2003). Fear resulting from risks often leads to restrictions that are more severe than the magnitude of the risk dictates (Jensen, 2002). Experts should aim to address public reactions even if those reactions seem irrational (Bidwell, 2013; Eyles et al., 1993). There are limits to education campaigns, with cultural bias having a strong influence on risk perceptions, which is sometimes impossible to influence (Baxter et al., 2013; Siegrist & Cvetkovich, 2000). Ultimately, risk only becomes acceptable by comparing the alternatives and acceptable risks should not be considered individually but alongside all possible outcomes from a variety of electricity generation systems (Jensen, 2002). Efforts should be made to bridge the gap between how the public perceives risks associated with energy infrastructure and the expert-assessed risk before proceeding with development of energy infrastructure.

The final stage of research (Chapter 5) was an interview-based study of residents and representatives from communities with wind turbines. This research focussed on sources of

opposition, how this opposition was shaped by the decision-making process, and how opponents contextualise their opinions of wind turbines in the fields of policy and electricity generation.

5. Understanding support and opposition to wind turbine development and assessing possible steps for future development

5.1. Overview

Wind turbine development in Ontario, Canada has been met with opposition yet will likely continue given broader environmental and economic forces. Ontario has ceased the use of coal for electricity generation and the populace has indicated that increased nuclear capacity is undesirable; renewables are a viable alternative. This paper captures experiences with and opinions of wind turbines in politicians and community members to determine which characteristics of development led to acceptance or opposition towards wind turbines, and which changes to policy and decision-making processes may address opposition. A constant-comparison case study, based largely on in-depth interviewing, was conducted with 24 participants who were MPPs, members of local government, and community members. The findings centre on two emergent themes: concerns with current decision-making processes, and options for addressing these concerns though changes to policy and development processes. Key findings were that perceived inequalities (between neighbours, within communities, and within the province) were the main source of opposition related to wind turbines and that future development may be more amenable if partnered with increased compensation or community ownership. Community members were absolutist in their opposition compared to politicians who identified advantages and disadvantages of wind turbines.

5.2. Introduction

Renewable energy technologies such as wind turbines will be a necessary part of our energy system in the future given that fossil fuels are finite and polluting (Holburn, 2012; Krupa, 2012) and Ontarians have more favourable views of wind energy compared to sources such as nuclear and coal (Oraclepoll Research, 2012). The development of wind turbines in Ontario, supported

by a Feed-In-Tariff program and streamlined approvals process which removed municipal control over development, has often been met with local opposition (Deignan et al., 2013; Fast & McLeman, 2012; C. Walker et al., 2014). In some cases, residents have become fiercely opposed to wind turbines, investing significant personal resources to thwart development (Spears, 2012; Spears, 2013). This is illustrated by self-reported annoyance resulting from wind turbine exposure being 3 times greater in Ontario compared to the province of Prince Edward Island (Michaud et al., 2016) and by the observation that Ontarians report greater annoyance related to visual aspects of wind turbines, especially those who are exposed to greater wind turbine noise (Michaud et al., 2016).

Opposition to wind turbines results from aesthetic preferences (spatial proximity, anticipated visibility, former land uses) (Hall, Ashworth, & Devine-Wright, 2013; Jobert et al., 2007; Jones et al., 2011; E. Pedersen et al., 2010), implementation (amenity agreements, planning processes, project accessibility and participation, integration of the developer) (Bakker et al., 2012; Coleby, Miller, & Aspinall, 2009; Jobert et al., 2007; E. Pedersen et al., 2010), and health risk perceptions (Baxter et al., 2013; Deignan et al., 2013; McCunney et al., 2014). Solutions for opposition have been suggested: economic incentives for communities, health risk communication strategies, policy changes, or decentralization of development (Deignan et al., 2013; Jobert et al., 2007; Jones & Eiser, 2010; Nadai, 2007). Community-based wind development has been successful in Germany and Denmark and has been suggested as a possible solution to wind turbine opposition (Bell et al., 2005; Toke, 2005b; G. Walker, Devine-Wright, Hunter, High, & Evans, 2010; Warren & McFadyen, 2010).

After an evaluation of the approvals process for wind turbine development, which had been criticized for relying entirely on provincial-level decision-making, Ontario established a Large

Renewable Procurement policy that will give preference to proposals that indicate agreement from the municipal government and landowners abutting the wind turbines (Ministry of Energy, 2016) but does not address the lack of acceptance in communities where development has already occurred (Jobert et al., 2007; Ministry of Energy, 2012). There is research examining the reasons for wind turbine opposition among community members in Ontario (C. Walker et al., 2014) but there is not yet research examining how to improve the current decision-making process.

This research takes the form of an interview-based constant-comparison case study to inform a grounded theory approach. The constant-comparison method creates distinction and comparison at each stage of the analysis between and within interviews, viewpoints, or participant groups (Charmaz, 2014, p. 131-132). A grounded theory is induced from the abstract understanding of these similarities and difference and the resulting theory represents a specific social phenomena that is grounded within data (Charmaz, 2006, p. 178-180; Charmaz, 2014, p. 181-182).

The research aims to capture experiences of local stakeholders in Ontario communities with wind turbines to determine which aspects of decision-making led to acceptance or opposition towards wind turbines, and to provide options to address this opposition through changes to policy and decision-making processes.

5.3. Interview process

5.3.1. Recruitment

The potential participants were identified through purposeful sampling by community, to be consistent with a previously conducted epidemiological study (Paller et al., 2016). There were eight communities of interest from which participants were recruited. These communities can be broadly characterised as rural farming communities with variation in the proportion of the

population that are seasonal residents. Some communities have experienced economic downturn resulting from recent losses of industrial jobs while one community is economically stable as a result of well-paid jobs at a local electricity generation station.

In the first stage of recruitment, members of local government (mayors or councillors), Members of Provincial Parliament (MPPs), and civil servants representing the provincial government were contacted. Email invitations were sent along with the study information letter. Four attempts (two emails, two phone calls) were made over the course of three weeks in October 2016, a modification of practices (incorporating email contact) recommended in the literature (Dillman, 1978; Dillman, 2011) . Participants who did not reply to any of these attempts were then removed from the potential participant list. Participants who were MPPs and members of local government were asked to participate in snowball sampling to help recruit community members; this involved receiving permission from potential referrals before sharing contact information with the researcher. This was done in accordance with university ethics guidelines and required potential community member participants to agree, via the MPP or member of local government, to be contacted by the researcher before contact information was shared. Non-participant community leaders who replied to the request for participation with a refusal (i.e., claimed to be too busy for an interview or not knowledgeable about the topic) were asked to participate in snowball sampling.

In the second stage of recruitment, a heterogeneous group of community members who were knowledgeable about the issue was recruited for participation through snowball sampling, as described above. The study recruitment materials (information letter and consent form), which had been sent to potential participants via email, were shared with an activist group without the researcher's knowledge and this resulted in the researcher receiving emails from interested

parties across the province. Many community members contacted the researcher with an offer to participate. After performing a number of interviews that exceeded the research plan and sensing that research themes had become saturated (many opponents discussed the same issues and used the same terminology to describe these issues), offers from potential participants were turned down. Potential participants were contacted twice before it was assumed that they did not want to participate.

5.3.2. Participation

A total of 24 participants took part in a recorded phone interview. Participants included MPPs, members of local government, and community members (Table 5-1). Requests were sent to nine current or former staff at the Ministry of Environment and Climate Change and the Ministry of Energy who were involved with wind turbine policy and approvals; two declined the invitation and others did not respond. A key figure within the ministry met over the phone to discuss what participation would entail, agreed to participate, yet did not respond to future communications from the researcher. Non-response was equally likely among all participant groups, although non-participation (declined invitations) were most frequently received from politicians without providing reasons for choosing not to participate. All community members contacted through snowball sampling or contacting the researcher directly could be classified as opponents.

Table 5-1: Number of study participants from each category

Participant category	**Potential participants contacted**	**Participants interviewed**
Representatives from the Ministry of Environment and Climate Change and the Ministry of Energy	9	0
MPPs	8	3 MPPs, 1 MPP staff member

Mayors and members of community council	13 mayors, 9 members of community council	6 mayors, 2 councilors
Community members (with knowledge of the issue)	24 through snowball sampling, 25 contacted the researcher	10 community members
Other	2	2 developers
TOTAL	**65 (+25 contacted the researcher)**	**24**

5.3.3. Interviews

The interviews occurred over the phone using a teleconference line, which was a necessity given that participants were located across the province. This option, compared with in-person interviews also allows both the participant and the researcher to engage from a 'safe' location, gives the participant more privacy, and provides flexible scheduling. This method is limited in that the interviewer could not see the body language of the participants, experience the community in which the participant lives or other contextual factors, and may result in a stilted conversation. Before conducting the interviews the researcher reviewed the content included in the information letter and consent form and asked if the participant was consenting to participate in the interview and have the interview audio-recorded. Interviews were one-on-one and guided by a list of topics but largely led by the participant (Table 5-2), following the themes of the study questions but also functioning as conversations between the researcher and the participant, following the statements of the participant when relevant. All participants agreed to have their interview recorded. Study recruitment was concluded once the interviewer determined that study themes had been saturated and emerging themes were repeating (Guest, Bunce, & Johnson, 2006). Interview recordings were transcribed verbatim for analysis in NVivo.

Table 5-2: Research themes, research questions and interview questions

Theme	Research Questions	Example interview questions and prompts
Personal experiences	How have experiences with the development varied?	How did you first learn about the wind turbine development? What have your experiences been like since the wind turbines were developed? How do wind turbines fit in your community?
Opinions of energy options	Which energy technologies do stakeholders believe are the best option for Ontario? How do stakeholders rank different energy sources based on a variety of criteria? Do community members concerned with wind turbines contextualize within the other energy options? Which aspects of an energy system are important to respondents? Do these aspects vary?	Please tell me about what you feel is the most important criterion for new energy development. Why? What about location? Which of these do you think would be most preferable to have developed in your community? (By that I mean living within 1-2km of the infrastructure) What about cost? What about environment? Which characteristics that I haven't mentioned do you think are most important for deciding on energy generation technology?
Opinions of wind in context	Where do respondents place themselves in the wind turbine debate? Which aspects of wind turbines are seen as positive? Which aspects of wind turbines are seen as negative?	To what extent would you consider yourself an opponent, neutral, or a proponent? Which aspects of wind turbines do you see as beneficial? What are some of the negative aspects of wind turbines? How do other energy sources compare to wind on these aspects? (list each: Hydro, Solar, Nuclear, Gas, Wind, Solar, Coal)
Democratic decision-making	Is there a way to improve decision-making to reduce opposition to wind turbine development?	Tell me about how the decisions were made to develop wind turbines in your community? Who was part of the process? Do you have any thoughts on this? Do you think there are other, better ways for this to have occurred?

		Do you think a different process would have changed opinions of this development?
Local ownership	Is there a way to improve ownership approaches to reduce opposition?	Who owns or developed the wind turbines in your community? Do you have any thoughts on this? Do you think that there are other, better ways for wind turbines to be owned? Do you think opinions of wind turbines would be different if they were owned by community groups or communities?
Compensation	Is there a way to improve compensation methods to reduce opposition?	Do you know who benefits financially from this wind energy development in your community? Do you have any thoughts on this? Do you think there are other, better ways for financial benefits to be distributed? Do you think that different compensation or financial benefits would have changed your opinion of wind turbine development?
Improvements to development	Overall, what changes do respondents want to see being made to wind turbine development?	If we were to start over, how would you have implemented or developed wind energy in your community? What type of planning processes or development would you have wanted to see?

5.3.4. Analysis and Rigour

An initial round of grounded theory coding was conducted on ten randomly selected interviews. Through this process, the data were defined using brief coding that closely represented the content of the interview and the point of view of the participant (Charmaz, 2014, p 111). For example, codes included 'ignored by government', 'caught off-guard', and 'better way to implement wind'. While coding, categorizations for these codes started to emerge such as 'community dynamics', electricity generation options', and 'health impacts'. Codes that were significant, frequent, or novel were organized into themes; redundant codes were merged or clarified (Charmaz, 2014, p 113). The interviews were reread and reassessed using this new coding structure, making changes to interview coding, codes, or themes when necessary. The remaining interviews were then coded using the same iterative process required for a constant comparison case study; coding was revised, codes were adapted to be more refined or broader, and themes were redefined and reorganized.

Triangulation of interviews was conducted by providing two additional researchers with copies of two interview transcripts for coding. These two interviews were purposively selected as they were dense with study themes yet shared little overlap (e.g. 'local oversight/control' vs. 'local power' or 'Liberal vs. Conservative' vs 'partisan politics'). This process resulted in further refinement of codes and themes. Reorganization of codes or recoding was not done as there was consistency between the results produced by all coders.

Member checking was conducted to give participants an opportunity to review and comment on preliminary findings from the interviews. Participants were sent a ten-page document highlighting key themes that were revealed through the analysis of the interviews (Appendix I). The member checking document was sent to 28 participants (24 were interviewed, 2 were

community leaders who wanted to support the study but chose not to be interviewed, 2 were local politicians who had contacted the researcher after recruitment, interviews, and analysis had concluded yet had a unique perspective and wanted to be involved) and 14 responses were received (50% response rate). Participants were asked to agree or disagree (on a 5-point Likert scale) as to whether their "opinions are represented on these pages" and were encouraged to provide any additional comments. Participants recognized the themes as being relevant in their communities, although three respondents strongly disagreed with the document. Those who strongly disagreed (two opponent community members and a developer) were contacted to see if they would be interested in discussing their opinions with the researcher. One participant declined the opportunity but indicated on the feedback form that the tone of the document was strongly biased toward wind energy. The other two respondents (an opponent community member and the developer) agreed to a phone conversation with the researcher. In both cases, after a lengthy discussion, the respondents agreed that the member checking document represented viewpoints in their communities and their disagreement stemmed from disapproval of the study objectives. The community member did not believe that qualitative research methods were worthwhile. The developer was concerned that some quotes could be taken out of context and used by activist groups. The results of member-checking were incorporated into the analysis through a revision of themes (a greater emphasis on government responsibility) and the narratives that introduced the topics and quotes were revised when participants highlighted pejorative tones or insufficient details describing the theme.

5.4. Study Findings

This section organizes the significant, frequent, and novel themes that emerged from the interviews into two groups that align with the study questions: (1) concerns with current wind

turbine development and decision-making, and (2) options for future policy and decision-making processes (see Appendix I for more detailed findings). It was expected that these groups would have different responses to the study questions, reflecting their roles and responsibilities as they pertain to wind turbine development with politicians contextualizing wind turbines and their shortcomings within knowledge of other energy technologies or benefits of wind turbine development. I classified participants as opponents, proponents, or neither according to explicit or implicit expression of their position during the interview. I made comparisons between community members and politicians; many politicians expressed they felt limited by the definition that implied politicians were not also community members.

5.4.1. Concerns over current decision-making processes

Both opponents and proponents discussed the importance of decision-making processes in shaping perspectives of wind turbines, both the factors considered in decision-making processes and the externalities that resulted from these processes.

5.4.1.1. Advantages and disadvantages of wind energy infrastructure

The advantages and disadvantages of wind turbines were weighed differently by proponents and opponents. Proponents, including those who approve of wind power but were displeased with implementation in Ontario, acknowledged strengths and weaknesses and concluded that there was a net positive effect, especially if potential economic benefits for the community were considered. Opponents disregarded all possible positive aspects of wind energy found in the general discourse and there was significant overlap in the rhetoric used by other opponents. One participant, a proponent mayor, felt that every type of electricity generation has advantages and disadvantages:

"I mean, any source of energy, there's always, there could be negative impacts but it's always a balancing act. … I have to be prepared to get the energy from some source. And if I'm going to look out my back window I would much sooner see a wind turbine than a nuclear plant."

An opponent community member implied that the externalities from manufacturing wind turbines negate possible positive environmental impacts:

"Like, they're really not green. When you look at how much carbon dioxide they put into the, into the environment and, you know, how they talk about carbon footprints, well they'll never erase their carbon footprints because they aren't going to produce enough energy to erase the ore that was mined and shipped to China, that they made into iron, to be shipped back to, to put these things in, and, you know, the lost production on the land that was out of production while the wind turbines were being built."

5.4.1.2. Perceived inequalities within and between communities

A frequent and novel theme was perceived inequality, with residents living among wind turbines seeing themselves on the losing end. The 'winners' in these circumstances are neighbours who chose to develop on their property and benefit financially, residents within the county who do not live nearby but who benefit from wind turbine amenity agreements, or urban dwellers within the province who approve of green energy initiatives but do not live among wind turbines. Neighbours 'sell out' by installing wind turbines because they are prioritizing their own financial interests above possible negative impacts on neighbours. An opponent community member felt that living near a wind turbine was a negative experience and that turbines were imposed on the community for the benefit of the rest of the province:

"If somebody decides to take one for the team on their own, great, good for them. But if you, you can't force people to take one for the team… I don't know how many thousands of Ontarians who are impacted in a, in a negative way so that other Ontarians can have green, green power. Like there's got, there's got to be something for them."

The perceived division between rural and urban Ontario, defined by many as Conservative-voting and Liberal-voting Ontario, was brought up by several participants. Some participants felt that the Liberal government was more willing to place what the participants perceive as undesirable developments in communities where votes are not needed to win a majority government, and others felt that wind turbine opposition was being used by Conservatives as a partisan wedge issue. Regardless of behind-the-scenes political decisions, it does appear that wind turbine development has served to intensify perceived divides between rural and urban Ontarians. One participant, a developer, thought that rural communities that feel they are hosting an undesirable technology for the sake of urban dwellers are mistaken:

"Everybody in rural communities thinks that we're on this one way street that looks like a subway, you know, subway tracks. So, you in Goderich are powering Toronto and Toronto can't generate any of its own power and they need to take it from everywhere else in the province so we're all feeding this big machine from an electricity standpoint. People don't, don't seem to understand that it is an up and down grid. It is made of many components in many different areas and it all goes into one big system – comes in, goes out, it flows. Electricity flows in many different directions. People don't understand that; they think that they, that once again, the benefit of Toronto is on the backs of the rural communities."

An opponent community member participant felt that development producing unfair outcomes should not be pursued even if it serves a common good:

> *"Well, they just tell you that, well, that, 'For the common good, yes some people may have to move. Some people may suffer health effects, some people, 16%, well, you know, that's just too bad because it's for the common good.' Well that's not the way we work in a democracy, right? We, I mean even if we knew that something was going to harm one percent of the people it would still be too much as far as I'm concerned. We should never on purpose harm each other. There's got to be better ways."*

5.4.1.3. Immediacy and visibility of impacts

Among opponents there was an acceptance of daily risk that did not extend to wind energy infrastructure. These inconsistent risk perceptions are evident in communities near the Bruce Nuclear Generating Station, with residents accepting the inherent invisible risk associated with nuclear energy and nuclear waste storage sites, while possible risks resulting from visible wind turbines are unacceptable. This apparent double-standard serves to highlight the difference between wind turbines and a nuclear energy plant that supplies the community with well-paid jobs. An opponent MPP staff member participant indicated that possible health risks from other electricity generation sources are inconsequential compared to wind turbines, as the turbines have a direct impact on daily life:

> *"None of them [other energy sources] bother me as long as they don't interfere with my life. Like, if I'm starting to get a little irradiation and my dog's getting sores on it then I got an issue…. I live [near a] wind turbine that has potential to keep me awake all night and give me vertigo so, I'll live by any of them except wind."*

An opponent community member participant accepts risks associated with living near a large landfill that contains polychlorinated biphenyls (PCBs), but felt that the addition of wind turbines to the community would introduce unacceptable risk:

> *"We have a problem here with the PCB storage in our town and they've been stored there I think since the '70s or something but again they're in the bedrock and they're being, you know, just sitting there. Now we think this is a big concern because all these vibrations on these turbines on, you know, on the bedrock could, could for example release these PCBs. But there's been no work done on really checking into that to see how safe it really is. Like, they, the nearest turbine's pretty close to where these, these PCBs are and again we say they should be a lot further away."*

5.4.1.4. Obligations to citizens

Participants indicated that the province had made missteps in conceiving of green energy initiatives and in implementing the development of wind turbines, which resulted in significant frustration with the province. Politicians indicated that the policy, decision-making processes, and communication with the province did not meet their expectations. One participant, a mayor, felt that the development of wind turbines had not been adequately justified by the government:

> *"What is the primary objective of these very costly initiatives? Does it in fact reduce greenhouse gases, how much and to what benefit? Does it benefit society as a whole or just well-connected companies and lobbyists? Is the alleged annoyance/harm to humans acceptable as the cost of achieving a policy goal? If these initiatives are to provide an environmental benefit, then we should have a mechanism in place to objectively measure these alleged benefits and report openly when they succeed and when they fail."*

An MPP felt that the province did not require developers to be accountable to communities and that community meetings were a disingenuous exercise:

> *"I think you can consult but if those concerns aren't addressed and there's a sense that there's an active disregard for those concerns and when tied to the parameters of the legislation it, it breeds frustration in communities where, yeah, sure, you know, we had meetings, you know, and we got to get up at a mic and talk about what our concerns were but, you know, that was it. So they, you know, if they're simply mandated to hold public meetings and make public announcements without any real, tangible triggers to address concerns then it's all for nought."*

5.4.2. Options for future policy and development

Participants considered whether different policy and decision-making processes would reduce opposition to wind turbines. Three options were frequent and significant study themes: local control, compensation, and local ownership.

5.4.2.1. Local control over development

Participants agreed that limiting the role of the municipality was fundamental to enabling the extensive wind turbine development that has taken place in Ontario. Opponents found this to be an unjust policy and proponents found this to be a necessary policy for reaching a provincial goal. Participants highlighted that no approach to decision-making will appease everyone. An MPP addressed the importance of balance between local control and provincial-level goals and indicated that balance is lacking in wind turbine development:

> *"Where do you find balance given that power generation is solely the discretion and jurisdiction of the province … to have a municipality be able to block that when, you know, the, the prosperity and the, all the considerations – prosperity, security, economic*

development – when those are at stake can you afford to have that, I guess, that potential roadblock in a municipality having that power. I understand that position. Again, or conversely I would say I appreciate that municipalities want a say in what happens in their, in their area and the development."

An opponent community member felt that local government should have the power to decide whether development should proceed, and that local decision-making would have abated opposition:

"You need to, to have a process that meaningfully engages the citizens' elected officials. And if your, if your town council cannot have a say in whether or not that development can occur within their municipality then I think people look at that and go, 'Well why not?' So if you had to give a first step, and I realize they're trying to make some changes in that regard, making it look as if the municipalities are more willing hosts, I think that would be number one. Then the average people I think are going to say, 'Ok, well, our town had a good look at it and if they think it's right for our community then we're onside with it.' But not having that ability is like, you're behind the eight ball kind of before you start."

A proponent mayor felt that local government should engage in decision-making but that it was the right choice to perform wind turbine approvals at the provincial level in order to meet larger goals:

"I, I think that, that more local and municipal consultation should be required as part of the process of screening potential development locations, but I, I personally, given, given our experience here over the last eight years, I personally don't think the ultimate veto power shouldn't (sic) *rest with the municipality….And I hope that doesn't sound like I'm*

kind of passing the buck but, but I think there are decisions around things like energy in our province that, that have to be made for the bigger public good. And I believe that's what the province has been trying to do – I do give them credit for trying – with green energy alternatives."

A proponent municipal councillor indicated that community government can make decisions that serve to appease the most vocal community members, in this case holding opinions in favour of local wind turbine development but voting to be an unwilling host community in order to appease vocal community opponents:

"When it came to our council, on two different occasions, at least one of them I was the only dissenting vote against that, and I was quite frankly shocked when that happened, that, that my colleagues would, would change their opinion so completely, I feel, based partly on just pressure from a very small group of residents."

An opponent community member indicated that local decision-making was unfair because it was not representative - not all members of council and their ridings were impacted directly by development and they voted accordingly:

"So geographically it's a huge municipality and the three councillors who voted for being a willing host, so it was three to two, was the vote, were kind of living and representing people that are like 60 kilometres away."

5.4.2.2. Economic factors and compensation as a mode to increase acceptance

Participants living near wind turbines described concern with decreased property values and property rights and felt that these issues required acknowledgement in some form. Although participants felt that compensation would be appropriate in this case and would reduce opposition, the implication that general opposition or health effects would disappear for the

'right price' was offensive. An opponent community member felt that local wind turbine development had reduced property value significantly, making a move from the community prohibitively expensive without compensation:

> *"I can't just sell it for two hundred, which I put into it and find another place for two hundred because it's no longer two hundred, so I mean compensation would be great so that I would then have the choice to sell it and move somewhere else."*

An opponent MPP staff member felt that regulations surrounding wind turbine development unfairly restricted the activities of abutting landowners, resulting in negative economic consequences without compensation:

> *"One huge issue is if, if you and I had adjoining farms and you wanted or were offered a turbine on your property and it was, it met all the right distances and everything but in five years I change my crops and I wanted to bring in offshore workers and put a bunkhouse in the back of my property I couldn't do it because of your turbine. Huge issue. Like you get locked in by what your neighbour did on your farm with no recourse."*

A mayor participant felt that wind turbine development could be contrasted with nuclear power that was well-integrated in the community through employment opportunities and economic benefits that created trust, familiarity, and acceptance of the technology:

> *"I don't think at any time during that 50 years that we ever had the types of complaints about health effects [from the nuclear plant] that we have had about just this one turbine here at C.A.W. [Canadian Auto Workers union] And I think it's part of it is, I always say it's, you know, it's your family member, it's your brother, your cousin, your uncle, your neighbour that works there, they come home every day and they're all very highly trained*

people so I think there's a better understanding of nuclear power in our community than there is probably 50 miles away where you don't see that. And there's no question it brings enormous economic benefit."

Economic factors are important to politicians and community members alike although these groups articulated their concerns through different avenues. Another participant, a proponent mayor, said that stimulus to an economically depressed community with few options is a net positive:

"The way I look at it, it's economic development for our community, is what it is. And, you know, we have limited opportunity when you're in a rural area such as ours so, you know, economic development like this is pretty major for everybody that's involved in it. So it's been good."

5.4.2.3. Local ownership as an opportunity to impact acceptance

Electricity generation in Ontario has traditionally been a public venture and participants were uncomfortable with the province allowing a foreign company to install and operate infrastructure. In cases where the development was perceived to negatively impact community members, the perception was that corporate partnership had taken priority over the well-being of the population. This ownership model also raises concerns about end-of-life decommissioning of wind turbines and whether a private company can be relied upon to be responsible for the wind turbines over their expected several decade lifetime. Participants showed contempt for the profits gained by large corporations, but did not agree with the notion that local or public ownership would improve acceptance of wind turbine development. A developer participant felt that the corporate nature of wind turbine development was an important contextual factor in the lack of acceptance:

"I do think there would have been a lot less squawking and a lot less, like, it would have been a less – I don't know how much less – but a less contentious issue, wind power in general. If it was still Ontario Hydro, and Ontario Hydro – See, because everybody back then, rural Ontario too was just used to, 'If Ontario Hydro says they're putting a big power line down our road, they're putting a big power line down our road and we can't do anything about it.' "

A proponent mayor connected opposition with negative perceptions of corporate partnership and agreed that local ownership would have made wind turbine developments more acceptable:

"…the concept of a cooperative at least makes it a little bit more tolerable in that the, the towers presumably are located on properties where the property owner is involved somehow as well as neighbours in the vicinity who would be potential beneficiaries from, from the income from the development … I could see that model being good in terms of people at least not saying, 'Well it's some big offshore corporation that's deriving all the income on the backs of we poor folks here' in whatever community it is."

5.5. Discussion

The main themes that were extracted in the interviews were: concerns over the current development and the decision-making process, and options for future policies. The findings indicate that wind turbine development is perceived differently by community members and local politicians and that this may be a barrier to reducing opposition.

Proponents of wind turbines communicated that, despite positive and negative characteristics, development of wind turbines was ultimately positive, whereas opponents could not express any positive characteristics related to wind energy when prompted. This is surprising given evidence that rural populations in Canada have a greater sense of environmental stewardship compared to

urban populations (Huddart-Kennedy, Beckley, McFarlane, & Nadeau, 2009) but is consistent with the 'absolute opposition' found in Ontario communities with wind turbines (Fast, 2015). A key negative issue expressed by participants was inequitable distribution of costs and benefits at several different levels, in agreement with research indicating rural Ontarians feel that they are bearing the impacts of undesirable infrastructure (Baxter et al., 2013; Cohen, Reichl, & Schmidthaler, 2014; Stokes, 2013b). These perceived inequalities appear to be the core of opposition in Ontario and are difficult to address given that multiple levels of perceived inequality exist (Bowdler, 2012; Groth & Vogt, 2014). This issue is further exacerbated by larger economic and demographic trends that have resulted in growth of urban areas in Ontario and a declining relevance of rural Ontario (Heinmiller, 2014). These feelings of inequality are disconnected from the larger context in which wind turbines are being developed, including climate change, risks associated with nuclear fission, and finite fossil fuels (Christidis, 2016). A surprising finding was that opponents living near a nuclear facility had confidence in nuclear power and this electricity generation infrastructure was not perceived as an undesirable development. Similarly, an opponent community member living near a landfill with reserves of hazardous waste considered this a benign baseline risk and was only concerned that the wind turbines might disrupt the waste. The acceptance of varying risks has been associated with fairness and informed choices (Rogers, 1998). Annoyance from wind turbines is related to concern for physical safety as a result of wind turbines in the community (Michaud et al., 2016) suggesting that risk perceptions may be rooted in feelings of annoyance. Although wind turbine exposure can cause annoyance, it is unclear why this exposure is perceived as riskier than other involuntary, low-level exposures with the potential for significant community-level harm ("acceptable risks") (Otway & Vonwinterfeldt, 1982).

The Ontario government streamlined the approval process for renewable energy development in 2009, removing municipal authority over wind turbine development (Ferguson, 2009) as a reaction to previous obstruction from local government (Hill & Knott, 2010; Watson et al., 2012a). With the exception of Chatham-Kent, a leader in development before the Renewable Energy Approvals (REA) policy was put in place in 2009 (Daniszewski, 2015), significant development of wind turbines occurred in the province after the REA. Participants speculated that without the streamlined process there would not have been development across Ontario at the scale realised, but whether the provincial implementation was a positive or negative outcome was not agreed upon. Participants described experiences in which municipal councillors who were personally in favour of wind turbine development felt pressured to be vocal opponents by a small, powerful group of constituents. These power structures would make development of wind turbines unlikely if municipalities were in control. This issue highlights innate shortcomings of any decision-making process: local decisions will not necessarily be representative of the community or more just. Under the REA, developers were required to host two community engagement events. Developers met the minimum requirements but other engagement activities were minimized as a reaction to confrontational and antagonistic meetings (Fast et al., 2016). Better engagement processes are difficult to quantify and mandate, and without appropriate incentives or guidelines from the province, developers will not go beyond the minimum requirements nor will they address concerns brought up in these sessions (Fast et al., 2016). The new Large Renewable Procurement (LRP) process improves requirements for municipal support and abutting neighbours but it has yet to be seen how this process will impact development and acceptance, especially among non-abutting neighbours (Ministry of Energy, 2016). If development slows down under the new policy it will appear that the REA was effective in

reaching its mandate and that the ends (greatly increased renewable energy generation) justified the means (limiting local involvement in decision-making processes). This was a concern among participants in this study who felt that the government was making undemocratic decisions in order to meet ambitious goals rooted in ideology.

As expected, perceptions of economic impacts were related to experiences with wind turbines (Bakker et al., 2012; Cohen et al., 2014; E. Pedersen et al., 2010). Those who benefitted from wind turbine development, such as property owners or a politician whose community benefits from an amenity agreement, felt that wind turbines had been a boon for the community. Those who are living among wind turbines but are not receiving any economic benefits focus on the perceived negative impacts wind turbines have on the economy, such as a high cost of electricity and decreased property values (Fast, 2015). The development of wind turbines exists under a new paradigm that concerned many participants: wind turbines and other renewables being developed and operated by large, profit-driven international corporations (Fast et al., 2016; Rosenbloom & Meadowcroft, 2014). To some, the successful operation of wind turbines is perceived as being misaligned with the 'public good' because the wind turbines are not owned by the province. Wind turbine development occurred for years in Europe without inciting opposition at the scale seen in Ontario, though in Europe local ownership has been an essential characteristic of wind turbine development (Bell, Gray, Haggett, & Swaffield, 2013; Bell et al., 2005; Devine-Wright, 2005a; Moller, 2006; Toke, 2005b). A study in the United States found that residents who leased land to wind turbine companies feel that they have been engaged in the planning process and are well-informed (Jacquet, 2015). Participants in this study were dismissive of local ownership as a factor that could have impacted opinions because of the implication that acceptance can be 'bought for a price.' However, concerns about inequality

between residents and large corporations, the provincial government, and their neighbours could be addressed through local ownership of wind turbine developments or increased compensation (Cohen et al., 2014; Graham et al., 2009; Phimister & Roberts, 2012). The willingness of participants to highlight the advantages of a nuclear plant in their community and dismiss disadvantages illustrates how important economic benefits are in establishing acceptance in a community, even if this connection is subconscious. Bruce Nuclear provides community benefits through job creation while also increasing local knowledge of the technology. Local ownership could serve to reframe wind turbines as a development for the public good while also addressing issues of compensation, as ownership would provide economic benefits to communities while avoiding issues of bribery, distrust, and developer transparency. It is worth considering that wind turbines, unlike other environmental stressors, are not an element in the environment that populations habituate to, as annoyance appears to increase over time (Michaud et al., 2016) making solutions to opposition necessary – negative sentiments will not necessarily fade away with time and familiarity.

This study was the first of its kind to purposefully interview politicians at different levels of government in addition to community members. Through the constant-comparison case study approach similarities and differences between politicians and community members were explored. MPPs used greater discretion in word choice and gave the impression that they were not sharing their true opinions, whereas the community-level politicians appeared to be providing their real opinions. Community members tended to be absolutist in their opposition (Fast, 2015) whereas politicians, even those who were opponents, were able to recognize the positive aspects of wind turbines and some cited the irrationality of some opposition. This contrast indicates an important finding that can be applied beyond research related to wind

turbines: absolutist opponents do not contextualize their viewpoints beyond personal impacts, making their concerns difficult to fully address. Members of local government, even in small communities, are more willing to interpret issues within the lens of a common good, which makes them more accepting of unwanted developments that provide benefits to their community and beyond.

This grounded theory study advanced the conceptual understanding of wind turbine opposition comparing the viewpoints of politicians to community members to examine whether larger contextual factors were considered in forming oppositional views (Charmaz, 2006; Lingard, Albert, & Levinson, 2008; E. Pedersen et al., 2007). Themes emerged during concurrent interviewing and analysis and as this happened, data were reassessed and reinterpreted. The member-checking process was not intended to result in a validation of the study results, but it provided an opportunity for participants to appraise the interpretations (Turner & Coen, 2008) and verify that their experience is reliably represented in the summary (Charmaz, 2014, p 210), as well as ensuring that the interpretation that the researcher provided does not overpower the narrative of the participant (Borland, 1991; Bradshaw, 2001). Further nuance was added to the study themes as a result of the member-check process. There are shortcomings to member-checking, all of which were experienced in this study: when there is a diverse group of participants with heterogeneous experiences (Turner & Coen, 2008), in cases when the interpretation is critical of participants (Bradshaw, 2001), or when the study reveals themes that the participant may not have been conscious of (Borland, 1991; Turner & Coen, 2008). Regardless, the process added rigour to the analysis of the interviews (Turner & Coen, 2008) and it is important to establish that the perceptions and contributions of the participants were valued (Robson, 2002, p 172). Further, responses to the member checking document reiterated the

notion that in some cases, reactions to the issues surrounding wind turbines are highly-charged and not necessarily germane.

There were limitations to this approach. The snowball sampling approach requires sharing information with a variety of potential participants and in this case the recruitment materials were shared with an activist group who then overwhelmingly responded with participation requests. Despite an openness to a variety of study participants, stronger inclusion and exclusion criteria would have been beneficial. Purposive sampling approaches (e.g. snowball sampling) are not intended to accurately represent the community-at-large or produce generalizable findings (Robson, 2002). Given that wind turbines have been operational for years in Ontario it may be that only the most passionate community members are still willing to discuss the topic; it was difficult to find a proponent community member who was willing to be interviewed although these viewpoints were expressed by mayors and members of community council who are proponents and double as community members. It may be that proponent community members are a "silent majority" who approve of wind turbines yet do not engage in debate. Stronger inclusion and exclusion criteria may have clarified the desire to speak with opponents and proponents when requesting that politicians share names of community members who may have been interested in participating. There was repetition in the answers from opponents during the interviews indicating that like-minded individuals are well-connected and approach discussions having read similar resources supportive of their perspectives. Further, long phone interviews such as these are intimate and can create a sense of familiarity between the researcher and the participant. Although this may be perceived as a positive effect, this seemed to create tension during the member-checking process. Participants who were community member opponents expressed disappointment and implied that they felt double-crossed. By my interviewing them

without debating the points, participants formed the impression that I was a friendly advocate about to embark on a biography or profile of their opinions, an impression that would not be expected after participation in an anonymous survey.

5.6. Conclusions

The main finding in this study was that wind turbine opposition appears to be rooted in perceived inequalities that could be addressed through economic benefits such as compensation or local ownership. Ultimately, many Ontario communities with wind turbines are living with a locally unwanted development that provides broad benefits to society, and it might have been expected that an imposed sacrifice would result in opposition. An unexpected finding was the apparent double-standard that wind turbines are held to compared to other energy infrastructure, especially nuclear facilities. Engagement practices for wind turbine siting mandated by law were inadequate, but opponents were opposed for reasons that cannot be addressed without ceasing development. It is fair to conclude that wind turbine development across Ontario would be a fraction of its current scale if it were not for the removal of municipal control over wind turbine development. Local ownership or increased compensation would likely have reduced opposition by creating tangible benefits for the host communities and would also have avoided the reliance on private corporations that was problematic for many participants. The themes examined in this study are not unique to wind turbine development and can be applied to most large-scale infrastructure developments.

6. Discussion/Conclusions

One of the primary objectives of this thesis research was to understand resistance toward wind turbine development in Ontario and how policy and decision-making processes relate to opposition. As the research progressed the focus of the thesis shifted accordingly. The themes that appeared to be most relevant to the topic and the study objective were related to perceptions of wind turbines, the impact that policy and decision-making had on perceptions, how perceptions relate to health effects, and how understanding of these relationships can be used to improve policy and decision-making processes.

The first chapter in this dissertation is a manuscript that reviews literature related to health perceptions and decision-making processes. The modest literature examining perceptions of wind turbines indicated the importance of psychosocial factors in moderating opinions of wind turbines. The possible mechanisms relating wind turbine exposure and health outcomes were reviewed and annoyance as a precursor to health effects was proposed as an alternative to a biological mechanism resulting from vibration or infrasound. The paper suggests that the decision-making process used to site wind turbines in Ontario may result in annoyance, which may then lead to negative health effects. Since the publication of this paper evidence suggesting annoyance as the primary outcome of wind turbine exposure has been put forward (Feder et al., 2015; McCunney et al., 2014). Annoyance in this field is defined as being something beyond an experience of daily life and could itself be considered a negative health outcome (McCunney et al., 2014). A review of the planning and decision-making processes that were used for siting wind turbines in Ontario and beyond was also performed in Chapter 2. The GEA and REA were described and the benefits and shortcomings of the top-down planning approach used to develop wind turbines in Ontario were considered. It is suggested that participatory and collaborative

decision-making processes could reduce negative perceptions of wind turbines and related annoyance. This paper establishes a central concept explored in this dissertation, which is that reported health outcomes related to wind turbine exposure are mediated by perceptions of the development process and the loss of control felt in communities. Since this paper has been published there have been changes to the approval process to encourage community engagement. Although there is evidence that opposition may decrease in communities where wind turbines have been operating (Baxter et al., 2013), it does not appear that changes to the approval process have resulted in improved relationships among developers and communities where new developments have been proposed (Fisher, 2016). The collaborative planning processes suggested may not be the most appropriate choice for meeting policy goals or reducing resistance based on more recent research performed since this paper was published. Collaborative planning requires flexibility from participants (Fainstein, 2000) which seems unlikely given the results from the case study (Chapter 5) and other literature that found opponents to be absolutist in their feelings towards wind turbines (Fast, 2013).

The second chapter describes the development of a pilot survey to assess health outcomes related to wind turbines. This paper describes the process to develop the pilot survey and test it in a community. The pilot survey was subsequently used in a much larger study of eight communities in Ontario with wind turbines (RETH survey). The RETH survey was designed to explore quality of life in nearby residents and whether there was a dose-response relationship between exposure to wind turbines and health effects. If health outcomes are psychosocial in nature a dose-response between exposure and health would not be expected. The pilot sample was representative of the population and the response rate was adequate (25.5%) so the pilot survey appeared to be an appropriate tool to assess a variety of factors related to living near a wind

turbine including health status, sleep quality, annoyance, and perceptions of wind turbines. Analysis of the RETH survey found evidence of a dose-response relationship between sleep quality and distance from a wind turbine. Most studies have not found evidence to support health outcomes related to wind turbine exposure outside of annoyance (Feder et al., 2015; McCunney et al., 2014). It is possible that there are nearby residents who are uniquely sensitive to noise (Oiamo et al., 2015) who may be experiencing a physiological response to wind turbine exposure

The third chapter is a factor analysis of three scales from the RETH survey. Two of these scales, addressing annoyance and living environment, were adapted for use in this study from research of residents living near wind turbines in the Netherlands, and the third was developed by the researchers to examine perceptions of specific issues related to wind turbine development in Ontario. The factors extracted from this analysis were contrasted with health outcomes also reported in the RETH survey through regression analysis. Significant relationships were found between three factors ('health and environment concerns', 'wind turbine sensitivity', 'noise sensitivity') and sleep, with 'health and environment concerns' and 'wind turbine sensitivity' also being related to health status. This study was the first to find significant relationships between perceptions of wind turbines and health status although the temporality of this relationship (which indicates causality) is unknown. Limitations of this study are the low response rate (9.7%) and the low comparability of the study sample with the population. These study results cannot be used to infer a temporal relationship between perceptions of wind turbines and health status. These findings work to broaden theories relating wind turbine exposure to health effects. Although there is evidence for a physiological response to noise and vibration (Seong et al., 2013) this research suggest that health effects may be psychosocial in nature (Fast et al., 2016). Although noise has been found to be related to annoyance, this

relationship was weak when compared to other variables (Michaud et al., 2016) that are more psychosocial in nature: concern for physical safety, noise sensitivity, personal benefit, dwelling type, home ownership, audibility of road traffic (Michaud et al., 2016). Research has found no relationship between wind turbine noise exposure and multiple different health outcomes such as chronic pain, asthma, arthritis, high blood pressure, bronchitis, emphysema, diabetes, heart disease, migraines or headaches, dizziness, or tinnitus (Michaud et al., 2016).

The fourth chapter in this dissertation is a case study that synthesizes the results of the three previous manuscripts, builds on the themes explored, and provides suggestions for policy and decision-making processes. The objective of the study was to determine which aspects of wind turbine development led to resistance and how policy can be adapted to address these concerns. Annoyance from wind turbines is more strongly related to visual aspects of wind turbines than high wind turbine noise (Michaud et al., 2016), indicating that the role of planning and decision-making are vital in shaping acceptance. Interviews with politicians and residents were performed inquiring about experiences with current development but more importantly, perspectives of wind turbines within the context of other electricity generation infrastructure options. By considering their perspectives, study participants would be considering strengths and weaknesses of wind turbines in the same way that a politician, public servant, or engineer would, as part of a larger system where all electricity generation sources have impacts and decisions are complex. Participants, even those reporting health effects, stated that health effects were rare within the communities, and many politicians speculated that the outcomes were psychosocial in nature. The study found that opponents to wind were absolutist in their negative opinions of wind turbines while proponents could express positive and negative characteristics of wind turbines. Many opponents expressed nuanced views of nuclear energy, weighing the strengths and

weaknesses, but did not interpret wind energy with the same nuance. A key finding was that opponents feel that wind turbines have created inequalities and that they are on the losing end of these inequalities, a finding that has been speculated previously as the true source of annoyance reported from wind turbine noise exposure (Bowdler, 2012). The results of this study indicate that if policy and decision-making processes can adequately address perceived inequalities, a major factor in resistance to wind turbines could be resolved. However, given the steadfastness of opposition, it may be impossible to adequately address perceived inequalities.

This thesis examines resistance to wind turbines and the relation of resistance to policy and decision-making, and provides a variety of findings that reflect the complexity of the topic (Petrova, 2016). By establishing the importance of policy and decision-making processes in perceptions of wind turbines (Chapter 1) and the relationship between perceptions of wind turbines and health effects (Chapters 2 and 3), a theory regarding the relationship between these factors emerged. This theory was explored further by performing case study interviews about experiences with wind turbines (Chapter 4). Although to some opponents in Ontario, issues with wind turbines are solely related to health risk, the findings of this research indicate that there are multiple different issues of concern, mostly dealing with policy and decision-making, consistent with similar research in the United States (Petrova, 2016). Given the variety in sources of opposition (Rygg, 2012), changes to policy or decision-making processes are not likely to address all concerns (Fast, 2015; Spears, 2012; Spears, 2013).

The results from Chapter 5 indicate that opposition is rooted in negative opinions of development and is rarely related to personal health impacts from wind turbine exposure. Although Chapter 1 suggests that collaborative decision-making processes are a worthwhile endeavour that could remedy wind turbine opposition, a deeper understanding of the topic indicates that this is an

overly simplistic view. Collaborative planning implicitly minimizes the weight of input from experts, which may have impacts on long-term planning and systems thinking in decision-making (Nadai, 2007; Nelson, 2008). In the case of wind turbines, the developments were unpopular under community-based decision-making processes and significant development of wind turbines only occurred under the top-down policy. It appears that opposition to wind turbines occurs regardless of the planning process used, and collaborative decision-making may prevent the successful implementation of ambitious long-term goals that are praised and desired outside of these communities (Hurley, 2015). Given larger issues of perceived inequalities it is unclear whether the Green Energy Act and Renewable Energy Approvals process could have been designed to avoid opposition. It is an unpopular opinion among opponents to state that improved amenity agreements could have addressed perceived inequalities (Cass, Walker, & Devine-Wright, 2010; Songsore, 2015) but research indicates that this is the case (Fast et al., 2016). Property owners hosting wind turbines receive financial benefits (Baxter et al., 2013) while abutting neighbours, if they receive compensation, receive a small fraction of the amount despite living in close proximity (Miner, 2012). Equitable dispersion of financial benefits can be achieved either directly through increased payments or indirectly through cooperative or community ownership (Bell et al., 2013; Bell et al., 2005; Graham et al., 2009).

It is worth contrasting the implementation and adaptability of the Feed-In-Tariff (FIT) programs in Ontario and Germany to understand best practices for these programs. Ontario's FIT program offers guaranteed fixed prices for renewable energy for 20 years that has met with criticisms and challenges: high prices offered for renewables, the streamlined approval process, and local content requirements (Stokes, 2013b). FIT is a policy that guarantees energy producers a set rate for their electricity output for a set length of time, regardless of the amount that is produced

(Dong, 2012). FIT is a way for government to show long term commitment to a specific energy development with consistent pricing which increases stability and investor certainty and is crucial for development of renewable energy technologies (Dong, 2012; Stokes, 2013b). Germany has developed renewables in conjunction with a larger Directive from the European Union, whereas Ontario is developing renewables for job creation and to replace coal – one provides greater investor and population confidence than the other (Mabee, Mannion, & Carpenter, 2012). Despite high costs, FIT is cost-effective in encouraging development of renewable energy technologies (Dong, 2012; Lipp, 2007; Menanteau, Finon, & Lamy, 2003). Research from the European Union suggests that high levels and sustained development of wind energy in Spain and Germany can be attributed to FIT policies (Menanteau et al., 2003; Toke et al., 2008). However, development in Europe has not met with the extent of opposition that has been seen in Ontario. Germany has had significant development of renewables with a FIT program and the differences between experiences in Germany and Ontario are worth exploring.

First, the siting processes in Germany has a better balance between regional government goals and municipal control than is the case in Ontario (Jobert et al., 2007). Local councils designate certain areas that are approved for wind power based on regional or national goals for renewable energy development. This creates trust and control for communities as well as stability for developers (Jobert et al., 2007). There is an incentive for municipalities in Germany to create designated areas because if they do not, wind farms can be built anywhere that meets national siting criteria and regions may be forced to accept wind energy development in areas they do not prefer (Jobert et al., 2007). In a system like this, regions could intervene if planning processes appear to be unjust or if potential sites have not been identified; the ultimate authority over

permissions and implementations should be given to them (Ottinger, Hargrave, & Hopson, 2013).

Second, the program in Ontario is simpler while the German model is more complex, using a degression model that reduces the FIT rate annually and providing less of a payout over time. Although both jurisdictions offer similar base rates for development, the degression model used in Germany provides a decreased tariff annually and encourages development to happen quickly while Ontario escalates rates over time to match inflation (Mabee et al., 2012). The German FIT program also offers financial bonuses to encourage certain types of development or locations. Ontario's FIT program has also encouraged, through pricing, the development of wind turbines above other renewable energy technologies and is relatively imbalanced with regard to technology types when compared to Germany (Mabee et al., 2012).

Renewable energy development in Ontario is typically done by large corporations that supply economic benefits to landowners hosting wind turbines and although the policy allows for and encourages community development and ownership, there has not been much interest in this option (Baxter et al., 2013; Blackwell, 2013a; Hill & Knott, 2010; Ministry of Energy, 2012; Stokes, 2013b; Watson, Betts, & Rapaport, 2012b). The Globe and Mail reported that, as of 2013, 90% of Ontario's wind energy infrastructure is owned by large corporations (Blackwell, 2013b). These corporations supply economic benefits to landowners who host renewable energy technologies (i.e., wind turbines) with a payout of approximately $8000 per year while offering no benefits to adjacent or nearby neighbours (Baxter et al., 2013; Canadian Wind Energy Association, 2008). Community involvement was expected to be the backbone of renewable energy technology development in Ontario, but this has not been the case. The few community-owned developments that do exist are smaller (Blackwell, 2013b).

Broadly, the themes explored in this research are relevant to many other research fields and current policy and decision-making issues. Wind turbine opponents are often described as educated, high-income citizens much like anti-vaccine activists – both groups are characterised as being frustrated by power imbalances, feeling helpless against government and large corporations (Largent, 2012) and outreach and risk communication initiatives can consider these psychosocial factors accordingly. Wind turbine community engagement meetings have a reputation as being hostile and aggressive, similar to recent engagement meetings regarding a contested and unwanted transit expansion in Calgary after which the mayor cancelled future in-person community engagement activities because of inappropriate behaviour by a small minority of attendees opposing development (Bell, 2016). It appears that current forms of community engagement are inappropriate and ineffective, which threatens to undermine the process completely. There are interesting opportunities for related research in a number of fields, including responsibilities of government with respect to communication of unknown risks, the concept of annoyance as an antecedent to health outcomes or as a health outcome of its own, new approaches for stakeholder engagement, types of policies and amenity agreements that reduce perceived inequalities, or methods for communicating complexity related to decision-making.

There are two main limitations to the research as a whole (specific limitations are listed in each chapter). The topic of wind turbine development in Ontario is constantly evolving. This makes the work topical and interesting but also complicates the research process. The first manuscript in this dissertation (Chapter 2) suggests changes to decision-making processes and participation, and after the paper was accepted for publication, the province made changes to these processes, making the paper slightly less relevant. The same can be said for the analysis of health outcomes. The community members who are reporting health effects have a record of suggesting new

health and environmental outcomes over time which makes study design challenging. In some cases, when studies have not found a relationship between wind turbine exposure and health outcomes, opponents will suggest that there are other factors that the study did not consider: housing material, weather, season, 'stray voltage,' etc. This refusal to accept research findings is exacerbated by opponents performing their own research (May & McMurtry, 2015; McCunney et al., 2015) and the proliferation of risk perceptions in the media (Songsore, 2015). The second limitation is that very few people are impacted directly by wind turbines and they all have their own unique perspective. It is difficult to synthesize the available information and provide policy recommendations without relying on anecdotal experiences or generalizations from very small groups. This issue is also a concern for epidemiological research. It is difficult to design a strong survey around a self-reported outcome that exists in a small proportion of nearby residents, and there appears to be a strong desire amongst opponents to definitively prove whether wind turbines are a risk.

This research was performed on a dynamic topic as it evolved in real time. At the beginning of this project, there was little research examining the issues that had arisen in Ontario and defining a research question was not straightforward given how little was known about the topic. Health care practitioners, planners, policy makers, and researchers across the province have many questions about wind turbine developments and this work contributed to a greater understanding of the topic from several perspectives. The work performed added to the understanding of resistance to wind turbines in Ontario (Appendix J), how resistance was exacerbated by policy, and what policy changes can be made in the future. This work explored a topic that was novel and changing and by performing interdisciplinary research related to health, planning, and policy a greater understanding of opposition to wind turbines in Ontario has emerged.

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Appendix A: Survey Media release

University of Waterloo Renewable Energy Study coming to <name> County

WATERLOO, Ont. (xxday, mth. xx, 2012) – Over the next few weeks, residents of <name> County will receive surveys pertaining to the <wind power, solar power, biofuel> portion of the Quality of Life and Renewable Energy Technologies Study from the University of Waterloo.

The research team will send surveys to mailboxes of <name> County residents who live within five kilometres of a <wind turbine, solar farm, biofuel plant>.

“These health studies are an important part of our Research Chair program by helping us understand the relationship between the renewable energy technologies and potential health effects," said Waterloo Professor Siva Sivoththman, the Ontario Research Chair in Renewable Energy Technologies and Health.

Professor Phil Bigelow, an epidemiologist at the School of Public Health and Health Systems at Waterloo, is spearheading the research examining the specific relationship between reported health effects and living near renewable energy technologies.

"Residents who receive the survey in their mailboxes are highly encouraged to fill it out as it is critical that it captures the unique experiences of residents," he said.

In appreciation of the time that it will take to fill out the survey, participants will be entered into a draw for a chance to win a $250 gift certificate to Canadian Tire or a Samsung Galaxy tablet, valued at $250. Furthermore, selected participants will be invited to take part in the second part of the study, which will involve a more in-depth health assessment.

The University of Waterloo Renewal Energy Study will examine several different renewal energy sources. Approximately 5,000 residents living near these sources across Ontario will be invited to participate. For more information on the Ontario Research Chair program in Renewable Energy Technologies and Health, please visit http://www.orc-reth.uwaterloo.ca/.

For more information on study participation, please contact Tanya Christidis at XXX.

About the University of Waterloo

In just half a century, the University of Waterloo, located at the heart of Canada's technology hub, has become one of Canada's leading comprehensive universities with 34,000 full- and part-time students in undergraduate and graduate programs. Waterloo, as home to the world's largest post-secondary co-operative education program, embraces its connections to the world and encourages enterprising partnerships in learning, research and discovery. In the next decade, the university is committed to building a better future for Canada and the world by championing innovation and collaboration to create solutions relevant to the needs of today and tomorrow. For more information about Waterloo, visit www.uwaterloo.ca.

About the Ontario Research Chair program in Renewable Energy Technologies and Health

The Ontario Research Chair program in Renewable Energy Technologies and Health (ORC-RETH) at the University of Waterloo is a multi-disciplinary research group promoting research and educational activities in renewable energy technologies (RETs) and their health and safety

implications. Professor Siva Sivoththaman holds the Ontario Research Chair with annual funding of $300,000 for five years from the Ontario Ministry of Environment and administered by the Council of Ontario Universities (COU).

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Appendix B: Survey Information Letter

UNIVERSITY OF WATERLOO | SCHOOL OF PUBLIC HEALTH AND HEALTH SYSTEMS

Quality of Life and Renewable Energy Technologies

Dear Resident,

The Ontario Research Chair program in Renewable Energy Technologies and Health (ORC-RETH) at the University of Waterloo is exploring if there is a relationship between quality of life and living within close proximity of renewable energy technologies such as solar farms, wind farms, and biogas plants. This study will use different methods like surveys and physical assessments in hopes of understanding the potential quality of life impacts that may result from renewable energy technologies in Ontario communities.

Your community has been selected by our research team as one of several communities to be included in this project. Your experience and perspective is very important to understanding the role renewable energy technologies play in quality of life across Ontario.

The enclosed survey is the first component of our research program. The survey should take approximately 30 minutes to complete. The questions are intended to provide general information about you, your health and personal well-being, your community, and renewable energy technologies. Questions about your health and demographic information are asked for study purposes only. **This survey is for adults who live in this house regularly. To ensure our study selects people at random, we are asking the adult (18 years or older) in your household with the next upcoming birthday to fill out this survey. Please fill out the survey by yourself and only complete responses based on your own experiences and not the experiences of others.**

You may change your mind about participation and not return the survey. All questions are voluntary and you do not have to complete all questions to participate. All information you provide will be considered confidential. To ensure the confidentiality of individuals' data, each participant will be identified by a participant identification code known only to the University of Waterloo researchers. Any publications or reports that result from this study will primarily report average responses of groups of participants. In the case where individual data may be presented, the individual will not be identified. Your information will be stored safely and securely at the University of Waterloo at the School of Public Health and Health Systems. Any identifying information will be retained for seven years, after which it will be destroyed by confidential shredding. While de-identified data will be retained indefinitely, after this point, no identifiers will exist linking you to the data collected during this study. All information you provide will be kept confidential, except as required under law. There are no known or anticipated risks to participation in this survey.

If you are interested in participating in this study, you can complete the survey on your own time and return the completed survey in the enclosed, self-addressed, stamped envelope. We will then enter your name into a draw. If selected, you will receive a $150 gift card for a store of your choice. The amount received is taxable. It is your responsibility to report the amount received for income tax purposes.

UNIVERSITY OF WATERLOO | SCHOOL OF PUBLIC HEALTH AND HEALTH SYSTEMS

This study also involves a second component, which will include a more detailed health assessment in which you will be asked to undergo a heath assessment in your home by a nursing student and a research assistant from the RETH group. This assessment may include any of the following parts: providing a small hair sample, keeping a sleep diary and symptom journal for a week, collecting saliva samples for three days, completing a similar survey to this one, and allowing a research assistant to measure the Global Positioning System (GPS) coordinates of your home. If you are interested in being contacted to participate in the second component please indicate this on the contact form. Not all participants who volunteer to take part in this component will be selected. You will receive up to $75 if you are selected to participate, depending on which and how many parts of the assessment you participate in.

If you have any questions about this study please contact Tanya Christidis (Project Coordinator) at the University of Waterloo **1-519-888-4567 ext. 31342** or tchristi@uwaterloo.ca. For more information about the Ontario Research Chair program in Renewable Energy Technologies and Health please visit http://www.orc-reth.uwaterloo.ca/.

This study has been reviewed and received ethics clearance through the Office of Research Ethics at the University of Waterloo. Should you have any comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin, Director of the Office of Research Ethics, at 1-519-888-4567, ext. 36005 or maureen.nummelin@uwaterloo.ca. Thank you in advance for your interest in this project.

Yours sincerely,

University of Waterloo Renewable Energy Technologies and Health Research Group

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Steve McColl, PhD
Laurie Hoffman-Goetz, PhD
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Tanya Christidis, MSc
James Lane, MSc Candidate
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Appendix C: Survey Envelope

UNIVERSITY OF WATERLOO | SCHOOL OF PUBLIC HEALTH AND HEALTH SYSTEMS

Dr. Phil Bigelow
Renewable Energy Technologies and Health Group
c/o School of Public Health and Health Systems
Burt Matthews Hall, University of Waterloo
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N2L 3G1

Appendix D: Survey

UNIVERSITY OF WATERLOO | SCHOOL OF PUBLIC HEALTH AND HEALTH SYSTEMS

Quality of Life and Renewable Energy Technologies Study

It is critical that this survey captures the unique experiences of different kinds of residents in communities with renewable energy technologies. We strongly encourage you to take part in this survey, because your particular experience is important to help improve renewable energy policy in Ontario.

This survey is for adults who live in this house most of the time. To ensure our study selects people at random, we are asking the adult (18 years or older) in your household with the next upcoming birthday to fill out this survey.

CONTACT INFORMATION

If you have any questions about the study at any time, please contact Tanya Christidis (Project Manager) at 519-888-4567 ext. 31342 or (tchristi@uwaterloo.ca).

GLOSSARY OF TERMS

Wind farm: A collection of wind turbines that generates electricity to be sold on the electrical grid. This does not include wind turbines installed to generate electricity for a single household or building.

Solar farm: A collection of solar panels that generates electricity to be sold on the electrical grid. This does not include solar panels installed to generate electricity for a single household or building.

Biogas plant: A facility that converts farm wastes and/or crops into a fuel that is burned to generate energy or electricity to be sold on the electrical grid

RETURN INFORMATION

Once you have completed the survey, please return it along with your contact information form to the School of Public Health and Health Systems at the University of Waterloo in the self-addressed, postage paid envelope.

SURVEY INSTRUCTIONS

If you would like help completing the survey please contact the project office using the contact information on the previous page. There are six parts to complete. The survey should take less than 30 minutes to complete.

This survey includes questions about you, your quality of life, and your community. You can choose not to answer any questions. Please read the instructions provided and choose the answers that appear most appropriate. If you are unsure about which response to give to a question, the first response you think of is often the best one.

The survey will consist of questions in tables with row(s) and columns like the example question on the bottom of this page about today's weather. Some questions will be "fill-in-the blank" format and will ask you to report an answer without a list of options. In the example below you are being asked to show your level of agreement or disagreement with the statement "I'm enjoying today's weather" by selecting only one of the six possible answers. If you agree, circle the number 5. If you disagree, circle the number 1. If you neither agree nor disagree, circle the number 3. If your opinion fits between these three categories, you can select 2 or 4. If you don't know what your opinion is, you can check the box under "I don't know" to indicate this. It is important that you answer each question as best you can. Please choose only one answer per statement unless otherwise specified.

Thank you for participating in this survey!

EXAMPLE QUESTION

How well does the following statement describe your feelings today?

	Agree		Neutral		Disagree	I don't know
I'm enjoying today's weather	5	(4)	3	2	1	☐

Part 1: Renewable Energy in Ontario

The following section asks for your level of agreement/disagreement with statements related to renewable energy technologies.

How well do the following statements describe your view of renewable energy technologies in Ontario?

	Agree		Neutral		Disagree	I don't know
1. Ontarians have an obligation to reduce energy consumption.	5	4	3	2	1	☐
2. Ontarians have an obligation to generate cleaner electricity.	5	4	3	2	1	☐
3. Building wind farms to produce energy is acceptable if they are situated far away from homes.	5	4	3	2	1	☐
4. Building biogas plants to produce energy is acceptable if they are situated far away from homes.	5	4	3	2	1	☐
5. Building solar farms to produce energy is acceptable if they are situated far away from homes.	5	4	3	2	1	☐
6. Wind farms should be owned by people in the community.	5	4	3	2	1	☐
7. Biogas plants should be owned by people in the community.	5	4	3	2	1	☐

5

How well do the following statements describe your view of renewable energy technologies in Ontario?

	Agree		Neutral		Disagree	I don't know
8. Solar farms should be owned by people in the community.	5	4	3	2	1	☐
9. I am interested in renewable energy as a new source of income.	5	4	3	2	1	☐
10. A community that is producing its own renewable energy should receive electricity at a discount.	5	4	3	2	1	☐
11. Wind farms are built where the best available resources are.	5	4	3	2	1	☐
12. Biogas plants are built where the best available resources are.	5	4	3	2	1	☐
13. Solar farms are built where the best available resources are.	5	4	3	2	1	☐
14. Wind farms should only be located in communities that want this type of development.	5	4	3	2	1	☐
15. Biogas plants should only be located in communities that want this type of development.	5	4	3	2	1	☐
16. Solar farms should only be located in communities that want this type of development.	5	4	3	2	1	☐

How well do the following statements describe your view of renewable energy technologies in Ontario?

	Agree		Neutral		Disagree	I don't know
17. Wind farms are a risk to wildlife.	5	4	3	2	1	☐
18. Biogas plants are a risk to wildlife.	5	4	3	2	1	☐
19. Solar farms are a risk to wildlife.	5	4	3	2	1	☐
20. Wind farms can cause negative health effects in nearby residents.	5	4	3	2	1	☐
21. Biogas plants can cause negative health effects in nearby residents.	5	4	3	2	1	☐
22. Solar farms can cause negative health effects in nearby residents.	5	4	3	2	1	☐
23. Wind farms are too visually dominant in a rural landscape.	5	4	3	2	1	☐
24. Biogas plants are too visually dominant in a rural landscape.	5	4	3	2	1	☐
25. Solar farms are too visually dominant in a rural landscape.	5	4	3	2	1	☐
26. Renewable energy technologies produce dirty energy (stray voltage).	5	4	3	2	1	☐

27. In your opinion, what is an appropriate setback (minimum distance from the closest home) for wind farms in Ontario?

_____metres OR _____miles ☐ I don't know ☐ I don't care

28. In your opinion, what is an appropriate setback (minimum distance from the closest home) for solar farms in Ontario?

_____metres OR _____miles ☐ I don't know ☐ I don't care

29. In your opinion, what is an appropriate setback (minimum distance from the closest home) for biogas plants in Ontario?

_____metres OR _____miles ☐ I don't know ☐ I don't care

30. If you would like to elaborate on any of your answers to the above questions in Part 1, please do so here:

31. How likely would you be to search for information about renewable energies (such as wind turbines, solar, biogas) for any reason?

☐ Very likely ☐ Somewhat likely ☐ Somewhat unlikely ☐ Very unlikely ☐ I don't know

32. The most recent time you looked for information about energies (such as wind turbines, solar, biogas) and health, where did you go to first? (check only one in this box)

☐ Books
☐ Brochures, Pamphlets, etc
☐ Community association
☐ Family
☐ Friend/Neighbour/Coworker
☐ Doctor/Health care provider
☐ I've never looked for such information
☐ Internet
☐ Library
☐ Magazines
☐ Newspapers
☐ Telephone Information Number
☐ I don't know

☐ Other (please specify): _____

33. Where else did you look or go to for information about renewable energies (such as wind turbines, solar, biogas) and health? (check only one in this box)

☐ Books
☐ Brochures, Pamphlets, etc
☐ Community association
☐ Family
☐ Friend/Neighbour/Coworker
☐ Doctor/Health care provider
☐ Did not look anywhere else
☐ Internet
☐ Library
☐ Magazines
☐ Newspapers
☐ Telephone Information Number
☐ I don't know

☐ Other (please specify): _____

34. Was there somewhere else that you look or go to for information about renewable energies (such as wind turbines, solar, biogas) and health? (check only one in this box)

☐ Books	☐ Internet
☐ Brochures, Pamphlets, etc	☐ Library
☐ Community association	☐ Magazines
☐ Family	☐ Newspapers
☐ Friend/Neighbour/Coworker	☐ Telephone Information Number
☐ Doctor/Health care provider	☐ I don't know
☐ Did not look anywhere else	
☐ Other (please specify): _____	

35. The most recent time you looked for information about renewable energies (such as wind turbines, solar, biogas) and health was it for…

☐ Yourself	☐ For someone else	☐ For yourself and someone else	☐ I don't know

36. The most recent time you looked for information about renewable energies and health was it about...

☐ Wind turbines	☐ Other (specify):_____
☐ Solar	☐ Cannot recall name/ I don't know
☐ Biogas	☐ I've never looked for such information

37. Overall, how confident are you that you could get health-related advice or information about renewable energies (such as wind turbines, solar, biogas) if you needed it?

☐ Completely confident	☐ Very confident	☐ Somewhat confident
☐ A little confident	☐ Not at all confident	☐ I don't know

Based on the results of your most recent search for information about renewable energies (such as wind turbines, solar, biogas) and health, how much do you agree or disagree with the following statements?

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	I don't know
38. It took a lot of effort to get the information you needed.	4	3	2	1	☐
39. You were concerned with the quality of the information.	4	3	2	1	☐
40. The information you found was hard to understand.	4	3	2	1	☐

In general, how much would you trust information about renewable energies (such as wind turbines, solar, biogas) and health …

	A lot	Some	A little	Not at all	I don't know
41. From a doctor or another health care professional?	4	3	2	1	☐
42. From government health agencies?*	4	3	2	1	☐
43. From a family member or friend or neighbor?	4	3	2	1	☐
44. From newspapers or magazines?	4	3	2	1	☐
45. From the television?	4	3	2	1	☐
46. From the internet?	4	3	2	1	☐
47. From community organizations?	4	3	2	1	☐
48. Other (please specify):	4	3	2	1	☐

_____

* (Government health agencies include the Ministry of Health and Long Term Care, the Public Health Agency of Canada, Health Canada and local health departments)

Part 2: Housing and Community

This set of questions will ask about where you live and the characteristics of your community. Please answer these questions referring to your home as the location where this survey was delivered. If this survey was delivered to a seasonal home, answer these questions based on your experiences in this summer home only.

1. This survey was delivered to a seasonal home (cottage, summer home, cabin). ☐ Yes ☐ No

2. For how many years have you lived at your current residence?

3. If you lived in another community before your current one, what was the postal code of your last residence?

4. What are the ages and genders of the people living in your home (including yourself)?

Person 1 (survey respondent)	Age:	☐ Female ☐ Male
Person 2 (if applicable)	Age:	☐ Female ☐ Male
Person 3 (if applicable)	Age:	☐ Female ☐ Male
Person 4 (if applicable)	Age:	☐ Female ☐ Male
Person 5 (if applicable)	Age:	☐ Female ☐ Male
Person 6 (if applicable)	Age:	☐ Female ☐ Male

How well do the following statements describe life in your community? Statements refer to the last **four weeks** unless otherwise stated.

	Agree		Neutral		Disagree
5. I spend a lot of time at home if possible.	5	4	3	2	1
6. When outside on a calm summer morning, I can hear only birds singing and other nature sounds.	5	4	3	2	1
7. Sound from agricultural machinery is a natural part of life in my community.	5	4	3	2	1
8. It is not very important what my community looks like, as long as it is functional.	5	4	3	2	1
9. The natural landscape around my house is relaxing.	5	4	3	2	1
10. I have renovated major parts of my dwelling since I moved in.	5	4	3	2	1
11. The area where I live is suitable for economic growth.	5	4	3	2	1
12. Background sounds from road traffic are almost always present outdoors near my dwelling.	5	4	3	2	1
13. I feel a sense of community with people living in this area.	5	4	3	2	1
14. I like to personalize my dwelling.	5	4	3	2	1

How well do the following statements describe life in your community? Statements refer to the last **four weeks** unless otherwise stated.

	Agree		Neutral		Disagree
15. I feel that 'big businesses' are invading my landscape.	5	4	3	2	1
16. I live in a progressive community with a sustainable future.	5	4	3	2	1
17. My opinion was considered in the social and economic development of this area.	5	4	3	2	1
18. I would like the chance to be more involved with my community.	5	4	3	2	1
19. I would be supportive of a community-owned renewable energy project.	5	4	3	2	1
20. I would like to be a part of a community owned energy project that offset my utility cost.	5	4	3	2	1
21. I have many friends in the community that I socialize with.	5	4	3	2	1
22. It is never really quiet in the area.	5	4	3	2	1
23. I am concerned about keeping the garden/backyard tidy.	5	4	3	2	1

Part 3: Environmental Stressors

This section asks about things in your environment that may be annoying to you. Please answer these questions referring to your home as the location where this survey was delivered.

The following statements ask about some things in your community that you may notice when you are **indoors**. Please indicate whether you have noticed these and whether they annoy you only when you are **indoors** in your home. Pick N/A if you don't live near or have any chance to have contact with the exposure.

	Very annoyed				Not annoyed/ Don't notice	N/A, not exposed
1. Odour from industries	5	4	3	2	1	☐
2. Odour from manure	5	4	3	2	1	☐
3. Flies and/or gnats	5	4	3	2	1	☐
4. Flicker from wind turbines	5	4	3	2	1	☐
5. Vibrations from a railway	5	4	3	2	1	☐
6. Vibrations from wind turbines	5	4	3	2	1	☐
7. Sound from agricultural machinery	5	4	3	2	1	☐
8. Sound from airplanes	5	4	3	2	1	☐

The following statements ask about some things in your community that you may notice when you are **indoors**. Please indicate whether you have noticed these and whether they annoy you only when you are **indoors** in your home. Pick N/A if you don't live near or have any chance to have contact with the exposure.

	Very annoyed				Not annoyed/ Don't notice	N/A, not exposed
9. Sound from road traffic	5	4	3	2	1	☐
10. Sound from railways	5	4	3	2	1	☐
11. Sound from wind turbines	5	4	3	2	1	☐
12. Visible power lines/pylons	5	4	3	2	1	☐
13. Visible factories	5	4	3	2	1	☐
14. Visible wind turbines	5	4	3	2	1	☐
15. Visible solar panels	5	4	3	2	1	☐
16. Visible busy road	5	4	3	2	1	☐
17. Other (please specify):	5	4	3	2	1	☐

_____

18. How would you describe the amount of time that you typically spend away from your home on **WEEKDAYS**? *(check all that apply)*

☐ Less than 2h (e.g. spend most of the day at home)

☐ 2h (e.g. running a lot of errands, volunteering)

☐ 4h (e.g. part time job)

☐ 6 - 10h (e.g. full time job)

☐ Other (please specify): _____

19. How would you describe the amount of time that you typically spend away from your home on **WEEKENDS**? *(check all that apply)*

☐ Less than 2h (e.g. spend most of the day at home)

☐ 2h (e.g. running a lot of errands, volunteering)

☐ 4h (e.g. part time job)

☐ 6 - 10h (e.g. full time job)

☐ Other (please specify): _____

Please indicate the distance you live from the following infrastructure. You can state the distance in either miles or kilometres. Note 1km = 0.6mi

20. The distance of the nearest solar farm to my residence is…

☐ Exactly _____km OR _____ mi	☐ I don't know
☐ Approximately 0 – 1 km	☐ Approximately 3 – 4 km
☐ Approximately 1 – 2 km	☐ Approximately 4 – 5 km
☐ Approximately 2 – 3 km	☐ More than 5 km

21. The distance of the nearest wind farm to my residence is…

☐ Exactly _____km OR _____ mi	☐ I don't know
☐ Approximately 0 – 1 km	☐ Approximately 3 – 4 km
☐ Approximately 1 – 2 km	☐ Approximately 4 – 5 km
☐ Approximately 2 – 3 km	☐ More than 5 km

22. The distance of the nearest biogas plant to my residence is…

☐ Exactly _____km OR _____ mi	☐ I don't know
☐ Approximately 0 – 1 km	☐ Approximately 3 – 4 km
☐ Approximately 1 – 2 km	☐ Approximately 4 – 5 km
☐ Approximately 2 – 3 km	☐ More than 5 km

Part 4: Sleep

The following section asks general information about your sleep habits.

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month.

During the past month…

1. What time have you usually gone to bed? *(please also circle a.m. or p.m.)*	_____ a.m./p.m.
2. How long has it taken you to fall asleep each night? (Once you have decided to go to sleep)	_____ minutes
3. What time have you usually woken up in the morning? *(please also circle a.m. or p.m.)*	_____ a.m./p.m.
4. How many hours of actual sleep do you get at night? (This may be different than the number of hours you spend in bed)	_____ hours _____ minutes

5. During the past month, how would you rate your sleep quality overall?

☐ Very Good ☐ Fairly Good ☐ Fairly Bad ☐ Very Bad

During the past month, how often have you had trouble sleeping because you…

	Not in the past month	Less than once a week	1-2 times a week	3+ times a week
6. Cannot get to sleep within 30 minutes?	1	2	3	4
7. Wake up in the middle of the night or early morning?	1	2	3	4
8. Have to get up to use the bathroom?	1	2	3	4
9. Cannot breathe comfortably?	1	2	3	4
10. Cough or snore loudly?	1	2	3	4
11. Feel too cold?	1	2	3	4
12. Feel too hot?	1	2	3	4
13. Have bad dreams?	1	2	3	4
14. Have pain?	1	2	3	4
15. Other (please specify):	1	2	3	4

_____

During the past month…

	Not in the past month	Less than once a week	1-2 times a week	3+ times a week
16. How often have you taken medicine (prescribed or "over the counter") to help you sleep?	1	2	3	4
17. How often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	1	2	3	4
18. How much of a problem has it been for you to keep up enthusiasm to get things done?	1	2	3	4

The following questions are about what generally interrupts your sleep.

During the past month, how often was your sleep interrupted by…

	Not in the past month	Less than once a week	1-2 times a week	3+ times a week	I don't know
19. Noises from inside your home?	1	2	3	4	☐
20. Road traffic?	1	2	3	4	☐
21. Aircraft and air traffic?	1	2	3	4	☐
22. Rail traffic?	1	2	3	4	☐
23. Wind?	1	2	3	4	☐

During the past month, how often was your sleep interrupted by…

	Not in the past month	Less than once a week	1-2 times a week	3+ times a week	I don't know
24. Ventilation system or air conditioner?	1	2	3	4	☐
25. Rain and/or thunderstorms?	1	2	3	4	☐
26. Wind turbines?	1	2	3	4	☐
27. Construction?	1	2	3	4	☐
28. Other (please specify):	1	2	3	4	☐

_____

If you would like to elaborate on any of your answers to the above questions in Part 4, please do so here:

Part 5: Health and Well-Being

The following questions ask general information about your health and well-being.

	Excellent	Very Good	Good	Fair	Poor
1. In general, would you say your health is...	1	2	3	4	5
2. In general, would you say your mental health is...	1	2	3	4	5
3. How would you rate your quality of life?	1	2	3	4	5

How often have you been troubled by the following symptoms in the last month?

	Never or seldom	About once a month	About once a week	Almost Daily
4. Headache	1	2	3	4
5. Depression	1	2	3	4
6. Not very sociable, wanting to be alone	1	2	3	4
7. Irritable	1	2	3	4
8. Resigned (e.g. feel like you've given up)	1	2	3	4
9. Fearful	1	2	3	4

How often have you been troubled by the following symptoms in the last month?

	Never or seldom	About once a month	About once a week	Almost Daily
10. Concentration problems	1	2	3	4
11. Nausea (e.g. upset or uneasy stomach)	1	2	3	4
12. Vertigo (e.g. feel as if the room is spinning)	1	2	3	4
13. Mood changes	1	2	3	4
14. Migraine Headache	1	2	3	4
15. Undue tiredness	1	2	3	4
16. Pain and stiffness in the back, neck or shoulders	1	2	3	4
17. Feeling tense or stressed	1	2	3	4
18. Unusual body sensations	1	2	3	4
19. Tinnitus (ringing in the ears)	1	2	3	4
20. Other (please specify):	1	2	3	4

The following questions are about activities you might do during a typical day. Does **your health now limit you** in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
22. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	☐	☐	☐
23. Climbing several flights of stairs	☐	☐	☐

During the **past 4 weeks** how much of the time have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
24. Accomplished less than you would like	1	2	3	4	5
25. Were limited in the kind of work or other activities	1	2	3	4	5

During the **past 4 weeks** how much of the time have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
24. Accomplished less than you would like	1	2	3	4	5
25. Did work or other activities less carefully than usual	1	2	3	4	5

28. During the **past 4 weeks**, how much did pain interfere with your normal work (including both work outside the home and housework)?

☐ Not at all ☐ A little bit ☐ Moderately ☐ Quite a bit ☐ Extremely

These questions are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the **past 4 weeks…**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
29. Have you felt calm and peaceful?	1	2	3	4	5
30. Did you have a lot of energy?	1	2	3	4	5
31. Have you felt downhearted and depressed?	1	2	3	4	5

The following questions ask about your satisfaction with various aspects of your life.

	Very satisfied		Neither satisfied nor dissatisfied		Very dissatisfied
32. How satisfied are you with your job or main activity?	5	4	3	2	1
33. How satisfied are you with your leisure activities?	5	4	3	2	1

The following questions ask about your satisfaction with various aspects of your life.

	Very satisfied		Neither satisfied nor dissatisfied		Very dissatisfied
34. How satisfied are you with your financial situation?	5	4	3	2	1
35. How satisfied are you with yourself?	5	4	3	2	1
36. How satisfied are you with the way your body looks?	5	4	3	2	1
37. How satisfied are you with your relationships with family members?	5	4	3	2	1
38. How satisfied are you with your relationships with friends?	5	4	3	2	1
39. How satisfied are you with your housing?	5	4	3	2	1
40. How satisfied are you with your neighbourhood?	5	4	3	2	1

41. During the **past 4 weeks**, how much of the time has your **physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?

☐ All of the time ☐ Most of the time ☐ Some of the time ☐ A little of the time ☐ None of the time

Below are five statements with which you may agree or disagree. Using the boxes below, indicate your agreement with each item. Please be open and honest in your responses.

	Strongly disagree			Nether agree nor disagree			Strongly Agree
42. In most ways my life is close to my ideal.	1	2	3	4	5	6	7
43. The conditions of my life are excellent.	1	2	3	4	5	6	7
44. I am satisfied with my life.	1	2	3	4	5	6	7
45. So far I have gotten the important things I want in life.	1	2	3	4	5	6	7
46. If I could live my life over, I would change almost nothing.	1	2	3	4	5	6	7

47. If you would like to elaborate on any of your answers to the above questions in Part 5, please do so here:

Part 6: Demographic Information

This section asks demographic information like your education and marital status. These questions are asked for the purpose of the study only. You may choose not to respond to any question(s) you prefer not to answer.

1. What is the highest level of education that you have received?

☐ Less than secondary ☐ High School Diploma
☐ College/University ☐ Post-Graduate or higher

2. What is your employment status?

☐ Full-time employment
☐ Unemployed
☐ Student
☐ Part-time employment
☐ Retired
☐ Other (please specify): _____

3. What is your occupation? If you are **not** currently employed, please indicate what your most recent occupation was.

4. Do you own or rent your home?

☐ Own (proceed to 5) ☐ Rent (proceed to 7)

☐ Other (please specify and then proceed to 7): _____

5. How much did you pay to purchase your property?

$ _____ ☐ I don't know

6. What was your property valued at in your final 2011 property tax bill?

$ _____ ☐ Estimated
☐ Looked it up
☐ I don't know

7. What is your marital status?

☐ Single ☐ Divorced ☐ Common-law
☐ Widowed ☐ Married ☐ Separated

☐ Other (please specify): _____

8. What is your best estimate of the total income received by all household members from all sources, before taxes, in the past 12 months? Income can come from various sources such as from work, investments, pensions, or government and is the amount you would report on your income tax.

☐ Less than $20,000 ☐ $20,000 - $40,000
☐ $40,000 - $80,000 ☐ $80,000 - $100,000
☐ $100,000 - $120,000 ☐ $120,000 and over
☐ I don't know ☐ Prefer not to answer

What is your address?

*This information will be used **ONLY** to measure distance to the closest renewable energy infrastructure and will **NOT** be used for **ANY** other purpose.*

Street address: _____

City/Town: _____

Township: _____

County: _____

Postal Code: _____

Lot (if applicable): _____ Concession (if applicable): _____

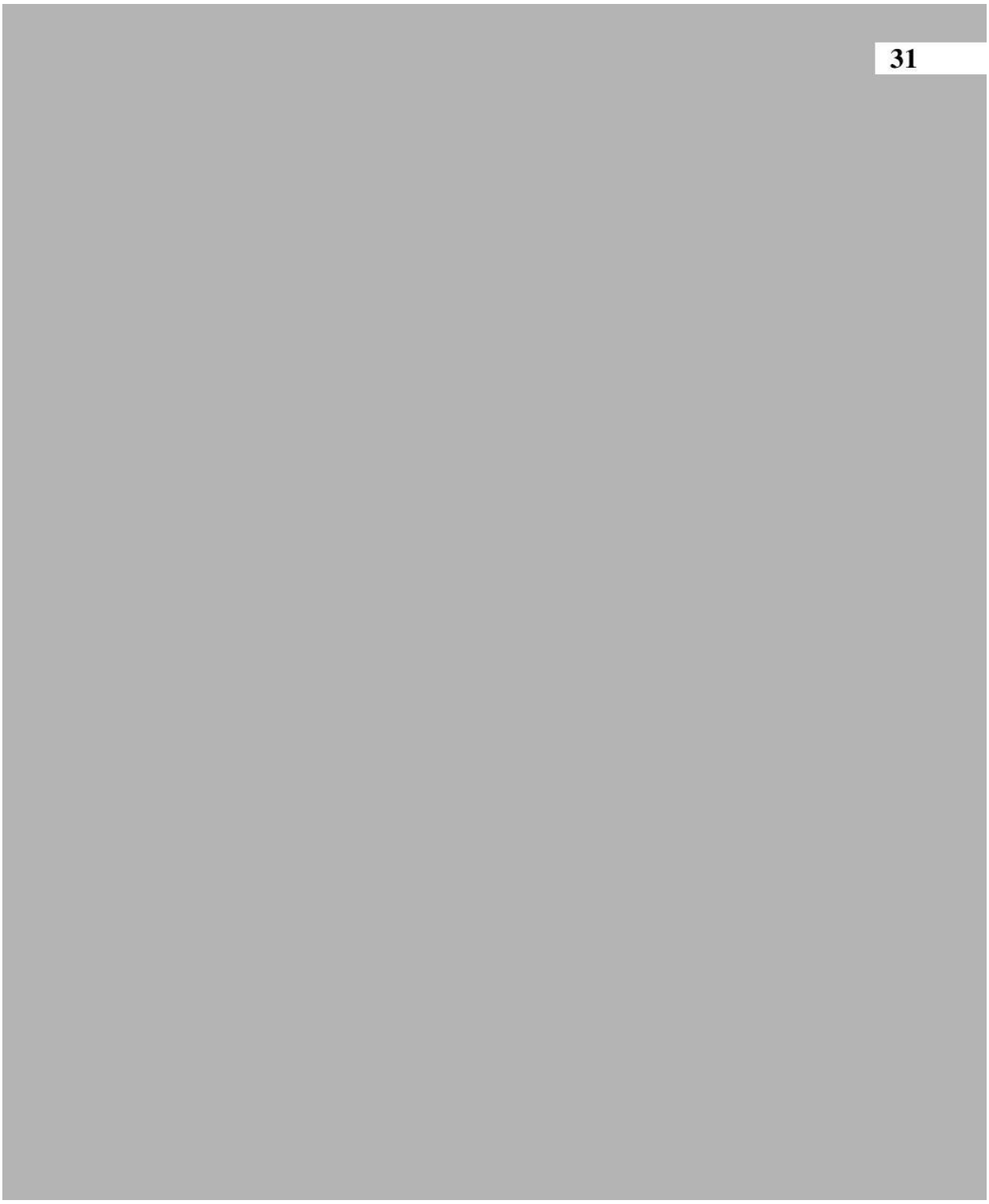
Emergency Locator Number/Fire Number (if applicable): _____

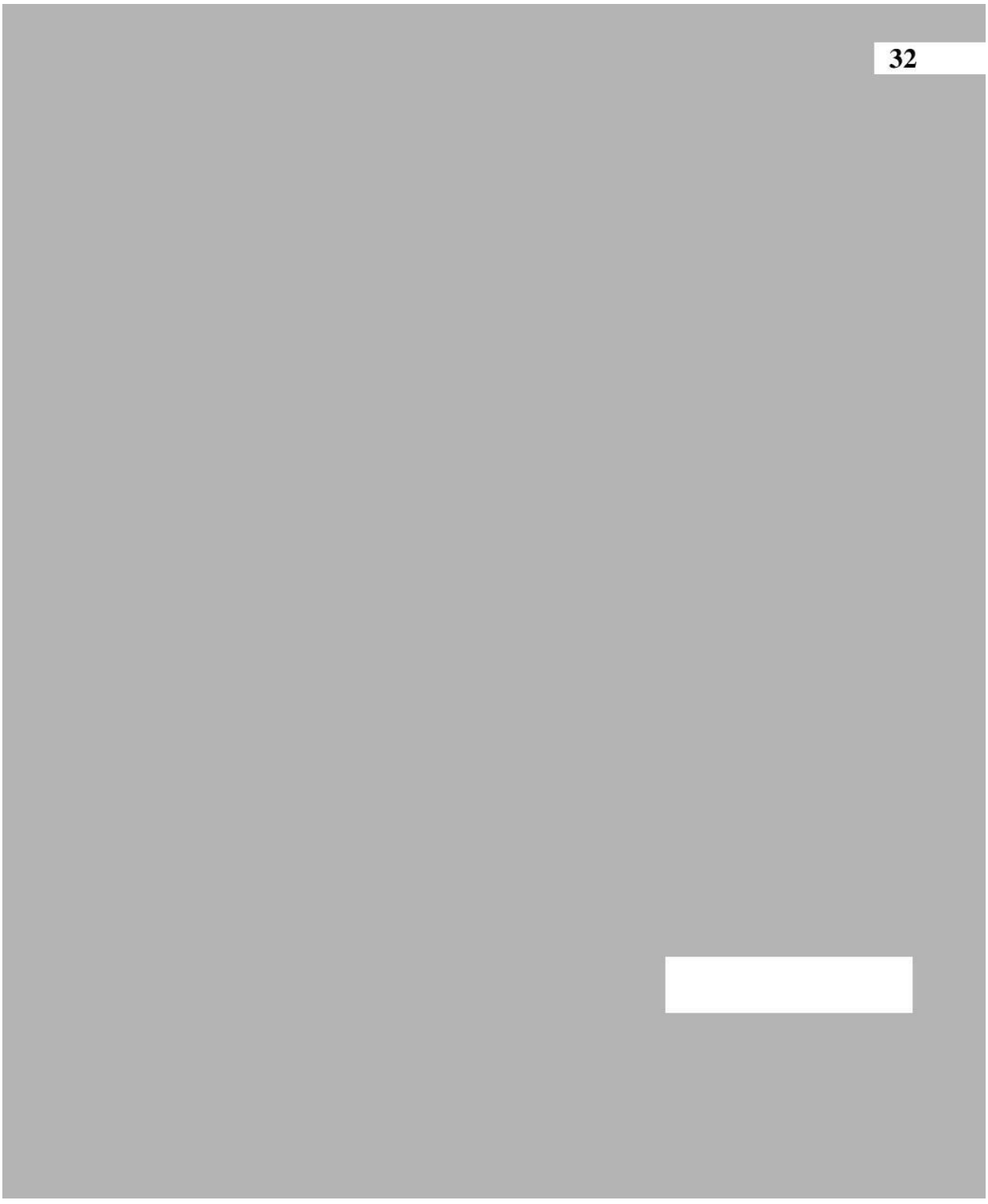
Please indicate today's date: (_____ / _____ / _____)
day month year

You have now completed the survey.
On behalf of the Renewable Energy Technologies and Health team, thank you very much for your time.

Please complete the contact form and include it in the return envelope if you wish to take part in the draw.

If you are interested in taking part in the second component of this research, more details are provided in the information letter and you can indicate whether you are interested in participating on the contact form.


31


32

Appendix E: Survey Contact Information Form

Contact Information Form – Survey Participant

This survey is for adults who live in this house regularly. To ensure our study selects people at random, we are asking the adult (18 years or older) in your household with the next upcoming birthday to fill out this survey.

Please provide your name, address, phone number, and email address below. This information will only be used to contact you if your name has been selected in our draw, provide you feedback on the study, and to contact you if you choose to be considered for participation in component two of the study. Include this contact information form in the return envelope, along with your completed survey.

Name:

Mailing Address:

Phone Number:

Email Address (optional):

Signature: **Date:**

The next portion of our research project will be a more thorough assessment of health. Participants who took part in this survey will be considered for the second assessment only if they are interested in doing so. Participants in component two will undergo a health assessment in their home by a nursing student and a research assistant from the Renewable Energy Technologies and Health group, provide a small hair sample, keep a sleep diary and symptom journal for a week, collect saliva samples for three days, complete a similar survey to this one, and allow researchers to measure the global positioning system (GPS) coordinates of their home. Preference will be given to interested participants who live closest to renewable energy technologies.

If selected, are you interested in being contacted for participation in the second part of this study? ☐ Yes ☐ No

Appendix F: Maps Used for Survey Distribution

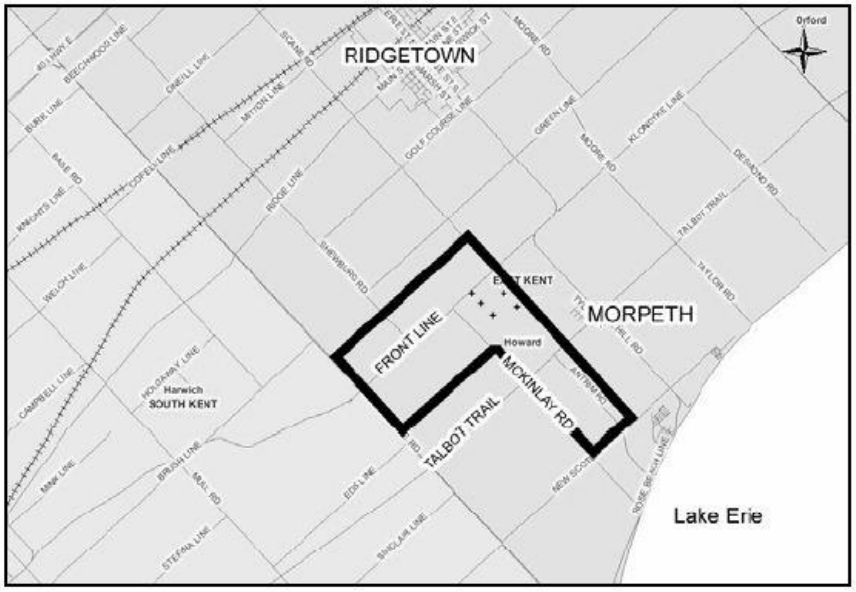


Figure 3-F: Map from the notice of completion for Front Line Wind Farm, used to create a large map of the wind turbines across Ontario

Figure 4-F: Wind turbines mapped between Chatham-Kent and Windsor, Ontario. This map included all wind turbines across Ontario

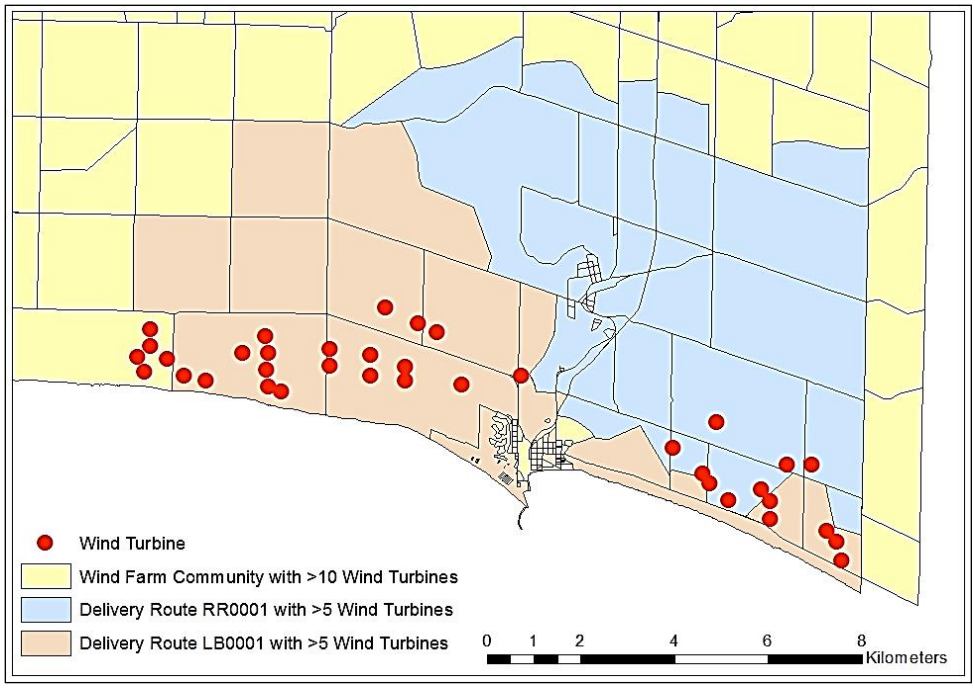


Figure 5-F: The locations of wind turbines, from map above, overlapped with Canada Post delivery routes (within a six-digit postal code) in a Southwestern Ontario community with wind turbines

Appendix G: Articles from wind opposition blogs or local newspapers

The following appendix includes the text from webpages, printed as pdfs as part of an ongoing effort by the RETH group to document the negative reaction to the RETH group and RETH survey. Many of these local wind opposition sites have since amalgamated and the pages no longer exist. I am happy to share the pdfs which include headers, advertisements, and sidebars to any interested parties. I have maintained the original formatting as much as possible and have included what I perceive as all of the pertinent content. Any misrepresentations of the articles or comments relating to the article are completely unintentional.

Article 1: Fill in a wind turbine health survey, WIN a Samsung tablet (!?)

from: http://ontario-wind-resistance.org/2012/11/26/fill-in-a-wind-turbine-health-survey-win-a-samsung-tablet/ [7/May/2013 11:07:27 AM] (Ontario Wind Resistance, 2012)

Fill in a wind turbine health survey, WIN a Samsung tablet (!?)

Posted on 11/26/2012

Orangeville Banner

Residents of Dufferin County who live within five kilometres of a wind turbine can expect to receive a survey in their mailboxes in the coming weeks. The survey, titled the Quality of Life and Renewable Energy Technologies Study, contains a portion investigating wind power. Professor Phil Bigelow, an epidemiologist at the University of Waterloo, is using the research to examine the specific relationship between reported health effects and living near renewable energy technologies. Upon completing the survey, participants will be entered into a draw to win a $250 gift certificate to Canadian Tire or a **Samsung Galaxy tablet,** valued at $250. Selected participants will also be invited to take part in the second part of the study, which involves a more in-depth health assessment. For more information on the Ontario Research Chair program in Renewable Energy Technologies and Health, visit orc-reth.uwaterloo.ca. For more information on study participation, call Tanya Christidis at 519-888-4567 ext. 31342 or email tchristi@uwaterloo.ca.

27 Responses to *Fill in a wind turbine health survey, WIN a Samsung tablet (!?)*

barbara *says:*
11/26/2012 at 22:06
Canadian Tire connections need to be done.

barbara *says:*

11/26/2012 at 23:36
Canadian Tire Corp., Toronto, Board includes:
Stephen G. Wetmore, Pres. & CEO >
Donald J. Lowry, EPCOR
Graham W. Savage >
Vincent J. Sardo, Capstone Infrastructure
David Lee Emerson, Stantec Inc.
Timothy Price >
John N. Turner, Northland Power
Harry a. Goldgut, Brookfield Renewable Power Inc.
Patricia M. Newson, AltaGas Ltd
James L. Goodfellow > Kenneth Rotman, Wellington Financial LP
http://investing.businessweek.com/research/stocks/people/board.asp?ticker=CTC:CN

WillR *says:*
11/26/2012 at 23:50
Barbara:
I see different names…

barbara *says:*
11/27/2012 at 11:22
Yes, there are many connections here and not all of the Board was looked at. But the group that was looked is shot through with connections to those involved in one way or another with IWTs. Information is provided so that people can look at a situation and make their own decisions.

snowball *says:*
11/26/2012 at 22:18
So our government funded "research team" is offering a prize for a health study?
Are you kidding me?
What the H is going on?

p *says:*
11/27/2012 at 09:40
What's worse is the prize is a Samsung product. The company who has invaded rural Ontario with IWT's. Some prize.

WillR *says:*
11/26/2012 at 22:40
If people are willing to participate in a study Phil Bigelow is probably the best bet… (Or should I say the "least worst" alternative?) As for the "prize" you can decline the opportunity and stick to business. Like trying to get some wide spread health reporting done.…or you can carry on.

Shellie Correia (@shelliecorreia) *says:*
11/26/2012 at 23:03
Not only would I not buy any samsung products, I would certainly not accept one for letting them study me to see how much damage they have done and then try to delve into your past health records to try to find something to blame your health issues on other than the turbines. They are obviously playing on the greed or ignorance of these people. They need to get some VOLUNTEERS to live next to these useless turbines, and WE will study them, starting with the executives of the turbine companies, their employees, the governments that support them and last but not least, the Green POSERS who promote wind energy without really knowing a damn thing

about it! we would be 100% better off researching ways to use as little energy as possible and produce it as cleanly and efficiently as possible. But that idea is boring, it will not buy votes, it will not make the rich people richer, it will not punish rural people for not voting liberal, and it just makes too much damn sense!!! Civil disobedience is the only solution when the government refuses to acknowledge the basic human rights of it's own citizens.

barbara *says:*
11/27/2012 at 11:24
Maybe the fix is in?

gaiagoddess *says:*
11/27/2012 at 05:24
Someone needs to enlighten this professor. A plethora of letters should litter his desk or at the very least, his computer.

snowball *says:*
11/27/2012 at 07:27
How will they capture gagged people including leaseholders and consider the families who have retreated and moved away because the ministry wouldn't help them? Samsung = Smitherman and backroom deals and now free goods courtesy of our government. Who might be inclined to give them the "right" answers in hopes of being favoured for the prize…right before Christmas……Shocking behaviour from our government

Lorrie *says:*
11/27/2012 at 08:25
University of Waterloo sinks to a new low. There were valid questions asked about this so-called study 2 years ago. Wind Vigilance forgot to ask if the research chair would offer a Samsung TV to try to get people to come forward.
Research Chair Choice Misses the Mark
The Society for Wind Vigilance expresses its concern over the announcement of its choice of Research Chair in Renewable Technologies and Health. Dr Siva Sivoththaman is an electrical engineer. While we wish him well, in our view Dr. Sivoththaman's professional background lacks the clinical expertise to evaluate "health impacts of renewable energy" associated with industrial wind turbines. As advocates for health protection The Society for Wind Vigilance believes that the lead and expertise of this Research Chair would more appropriately have been a clinician scientist. We strongly encourage the new Chair to seek the appropriate collaborators as a new the research program is established.

The SWV notes with concern that the first criterion in the RFP from the Ministry of Environment required that the responding institution have a faculty or discipline established for renewable energy technologies. Throughout the RFP, the required expertise, experience and qualifications continued to focus on renewable energy technologies. The health requirement appears to have been a secondary consideration if it was considered at all. These concerns have been communicated to the Ministry of Environment and the Chair of the Research Chair during the selection process. Health concerns from wind technology in Ontario must be addressed. These concerns exist due to the inadequate implementation of Ontario's renewable energy Policy. Front end health studies prior to establishing the renewable energy policy were not done. Vigilance monitoring and long term surveillance programs to ensure safe implementation were not established.

Volunteers for WindVOiCe© continue to conduct a vigilance health survey for new victims. WindVOiCe© follows the principles of Health Canada's Canada Vigilance, a post-market surveillance program by which healthcare professionals and consumers report adverse health effects suspected to be

related to a product. This is mandatory for Market Authorization Holders such as wind turbine manufacturers.

To date, one hundred and two Ontarians have reported adverse health effects from industrial wind turbines and the number is climbing.

he Society for Wind Vigilance calls upon the government to halt further development of industrial wind installations until a full independent, third-party study into the adverse health effects of industrial scale wind technology is complete.

Mitigation of problems with current wind developments must be agreed upon and corrective action taken.

According to the Ministry of Environment "there is no scientifically accepted field methodology to measure wind turbine noise to determine compliance or determine non compliance with a Certificate of Approval limits". Based on this, Ontario noise guidelines for industrial wind turbines do not seem enforceable. The recent RFP for noise specialists by Ontario's Ministry of Environment indicates that the technology and its affect on human health are not fully understood.

Ontario families cannot rely on protection from their government when turbinerelated noises cause sleep disturbance leading to other adverse health effects. Clinicians and medical experts must be independently appointed from outside the government and its public health officers to protect Ontarians.

ROBERT Y. MCMURTRY, M. D., F.R.C.S.(C), F.A.C.S.
Chair
The Society for Wind Vigilance
http://www.windvigilance.com

> **barbara** *says:*
> 11/27/2012 at 11:37
> Perhaps many more would speak up if they had a way of doing this without revealing their identity.
> This is not a nice thing to have to do but if those injured and or needing medicatrions to remain in their homes would supply this information for all Ontarians so these issues can be exposed. They need not identify themselves. When this happens the intimidations will stop. This is truly a very sad state of affairs!
>
> > **barbara** *says:*
> > 11/27/2012 at 15:48
> > Postings on the internet of photos, medications needed, etc. also provides a way to testify without being intimdated. Information for a jury of your peers.
>
> **Shellie Correia (@shelliecorreia)** *says:*
> 11/27/2012 at 15:27
> Thank you for the information about Windvoice, I had no idea such an organization existed. I have a letter from my 11 year-old sons specialist saying he is at serious risk of harm from turbine noise due to sensory issues that he has. We are slated to be surrounded with 3mw turbines, with one being the minimum setback distance of 550m. I would like to find out if anyone can help me before the turbines come because the cost of litigation is difficult to work into a family budget that is already strained to the max. I will try to contact these people, it sounds like we have some wonderful, compassionate and intelligent people helping us! For that I am grateful!

barbara *says:*
11/27/2012 at 15:52
Unpleasent situation you are in and if your son also becomes subjected to electrical shocks this will be very bad for him.

Petra *says:*
11/27/2012 at 08:33
OMG Bigelow doesn't get it, does he?
Rubbing salt in the wounds….
What a dick.

shocked and disgusted *says:*
11/27/2012 at 08:34
Do you find this research "unethical"? Or, at least, do you have questions about the "ethics" of this project?
If so, write to:
Susanne Santi, Office of Research Ethics, University of Waterloo
ssanti@uwaterloo.ca
Maureen Nummelin, Office of Research Ethics, University of Waterloo
maureen.nummelin@uwaterloo.ca
George Dixon, Vice President – Research, University of Waterloo
dgdixon@uwaterloo.ca
Feridun Hamdullahpur, President, University of Waterloo
president@uwaterloo.ca
Please, write them, or call them, and anyone else you find in the University of Waterloo directory to bring attention to these matters.

barbara *says:*
11/27/2012 at 11:28
You forgot the President and his connections.

barbara *says:*
11/28/2012 at 15:12
Do not throw away or return the survey. Keep the envelope too. Returned unanswered surveys could be filled out by someone else.

jannie *says:*
11/27/2012 at 14:54
What I have found interesting in my area in the US is that the universities who have connections – the department receives money or the lead teacher or chair speaks at the AWEA conferences — those studies always seem to come out to be no problems with wind turbines being close to people, no loss of property values, etc. It is just so…. surprising

Shellie Correia (@shelliecorreia) *says:*
11/27/2012 at 15:16
Stantec Incorporated is working for Niagara Region Wind Corporation in West Lincoln, they are so badly interwoven in the wind energy community, that I am sure it has got to be the largest scam ever perpetrated, as the same scenarios are being played out in countries all over the world, with the same M.O. Even down to the denial of health effects and the losses of property values, it's as if they are reading a manual on how to con an entire civilizations with false promises and anecdotal benefits, I sure hope the drugs wear off soon and this nonsense comes to an end before the province is too far in debt to claw it's way back out, like so many of the countries in Europe, or haven't the masses been paying attention? Wind

turbines did not help them at all, it only compounded their problems.,and gas power plants have not lost a minutes sleep, their future is secure, so lets get real and invest the money on producing hydro, nuclear power, gas, and all of our reliable energy sources as cleanly and efficiently as possible, and research can continue to find new, efficient, cost-effective, safe ways to carry us into the future. Industrial wind turbines are not technically equipped to do the job, their power is intermittent, their parts are not recyclable other than to burn them, and the wind companies claim it is too costly to locate them away from rural communities, so they claim they are safe via a pile of studies that they have either financed or through the government whom was backing them in their misadventure. Obviously they think everyone is blind, deaf, and dumb. How are they intending to compensate people who have been forced out of their homes and had their lives and communities torn apart by their feigned ignorance of the truth? The day of reckoning is on the horizon, the truth is starting to trickle out in spite of gag orders, bribes, sweetheart deals with local governments etc. I know there are very many of us out there who eagerly await the day the complete truth is made public, tangled webs and all.

> **DoNoHarm** *says:*
> 11/28/2012 at 18:13
> Gag orders – what are the severe consequences, that people are so afraid to speak up when their own health is being continuously compromised by IWT?
>
> **MA** *says:*
> 11/28/2012 at 18:42
> Good post Shellie. You nailed it.

Sick Turbines *says:*
Marlboro was offering a pack of smokes to anyone who wants to participate in a survey

Shellie Correia (@shelliecorreia) *says:*
11/27/2012 at 22:25
I sure hope the parallels are not lost on anyone. Smokes, thalidomide, asbestos, DDT, and the list goes on. Government sanctioned poisons are nothing new. The difference is this time we are being forced to take it.

Frances *says:*
11/28/2012 at 19:28
I wrote a formal letter to the university to complain and received what looks to be a form-letter reply. In it was the sentence: “we understand the concerns being raised and would like to acknowledge that the choice of a Samsung tablet as one of the two incentives was regrettable.” I wrote back and asked if they intended to do anything about it or just “regret” it, No response yet but we will see if they take time to respond to this email. My email to Tanya Cristidis and Phil Bigelow used much more colloquial language. But no reply yet from them.

Article 2: Is this a health study, or a sick joke???

from: http://ontario-wind-resistance.org/2013/03/06/is-this-a-health-study-or-a-sick-joke/

[7/May/2013 10:49:21 AM] (Ontario Wind Resistance, 2013)

Is this a health study, or a sick joke???

Posted on
03/06/2013

UNIVERSITY OF WATERLOO- Quality of Life and Renewable Energy Technologies Study
Read Survey
- Contact Form
- Information Letter
- Survey

Some examples from this survey:

How well do the following statements describe your view of renewable energy technologies in Ontario?

1. Ontarians have an obligation to reduce energy consumption.
2. Ontarians have an obligation to generate cleaner electricity.
3. Building wind farms to produce energy is acceptable if they are situated far away from homes.
4. Building biogas plants to produce energy is acceptable if they are situated far away from homes.
5. Building solar farms to produce energy is acceptable if they are situated far away from homes.
6. Wind farms should be owned by people in the community.
7. Biogas plants should be owned by people in the community.

In your opinion, what is an appropriate setback (minimum distance from the closest home) for wind farms in Ontario? _____ metres OR _____ miles _ I don't know _ I don't care The most recent time you looked for information about energies (such as wind turbines, solar, biogas) and health, where did you go to first? (check only one in this box)

_ Books
_ Internet
_ Brochures, Pamphlets, etc
_ Library
_ Community association
_ Magazines
_ Family
_ Newspapers
_ Friend/Neighbour/Coworker
_ Telephone Information Number
_ Doctor/Health care provider
_ I don't know
_ I've never looked for such information
_ Other (please specify): _____

In general, how much would you trust information about renewable energies (such as wind turbines, solar, biogas) and health.. .
41. From a doctor or another health care professional?
42. From government health agencies?*
43. From a family member or friend or neighbor? (sic)
44. From newspapers or magazines?
45. From the television?
46. From the internet?
47. From community organizations?
48. Other (please specify):
The following statements about some things in your community that you may notice when you are indoors. Please indicate whether you have noticed these and whether they annoy you only when you are indoors in your home. Pick N/A if you don't live near or have any chance to have contact with the exposure.
1. Odour from industries.
2. Odour from manure.
3. Flies and/or gnats.
4. Flicker from wind turbines
5. Vibrations from a railway
6. Vibrations from wind turbines
7. Sound from agricultural machinery
8. Sound from airplanes
Read Full Survey

57 Responses to Is this a health study, or a sick joke???

Sylvan Bob
says:
03/06/2013 at 21:37
This isn't about wind – it's about bio-gas/methane. I'm sure of that. The whole thing is a huge container of pig manure – I can smell it from here.

Sparky
says:
03/06/2013 at 21:58
These questions are absolutely preposterous !! where do they get these people that write this pig manure ! !If I received a survey with these questions, I'd burn it and ask the people involved with it to go back to the planet they came from...

barbara
says:
03/06/2013 at 22:19
A least keep a few copies for historical purposes as no one in the future would believe this was a government funded health study done by a university.

1957chev
says:

03/06/2013 at 22:53
They are spreading a lot of nonsense around the universities nowadays. Free thought is no longer encouraged, as a matter of fact, it is sternly frowned upon. The provincial government will tell them what to think. Not at all like the rebels of the sixties and seventies. Too bad.

Dan Wrightman
says:
03/07/2013 at 08:59
Silly you. The flies in your house are only annoying because you didn't get your information about flies from a reputable source. If only you had went to CANFEA (Canadian Flypoop Energy Association) instead. Than you would have learned that flies really aren't annoying and flypoop energy is just an affordable source of new electricity and is continuing to improve its cost- competitiveness.

MA
says:
03/07/2013 at 09:11
Yes, Dan. ....and the fly-poop is not ugly. It's beautiful....and soothing. Very soothing. Say it with me now.....

D p l
says:
03/06/2013 at 22:23
Dear energy companies of the World: Thank you for your participation in the human experience. Without you, we may have a more peaceful World where equality is a birthright; but there is always time for healing. With you, we have made your controllers quadrillions of dollars in "profit". The time has come for us to bid farewell to your corrupted policies, unethical practices, shallow decisions, and compromised integrity. Shove your questionnaire were the sun never shines

1957chev
says:
03/06/2013 at 22:50
The whole purpose of these questions, is to allow them to put you into one of their pre-ordained slots for anti-wind "receptors". They want to tell you that you have searched for information in all the wrong places, you have believed people and institutions you should not have. You should feel OBLIGATED to live near a turbine, and "do it" for the greater good. Turbine noise is no different than the flies that bother you in your house....(do these idiots know what we do to those flies?) And by the way, do the vibrations from that train that runs 24 hrs. per day, 7 days per week, cause any noticeable vibrations? It is obvious this "survey", and I use the term loosely, was designed for no other purpose, than to discredit, the victims that have had the nerve to speak out about this unjust abuse of rural communities. We need to make this sorry excuse for a medical questionnaire, public. This is the reason why they can deny the health effects. They are denouncing the word of the victims, before the issue has been investigated. They don't want the truth, they want a way to cover it up!

thebiggreenlie
says:
03/06/2013 at 23:08
And.....OUR $$$$ are paying for this piece of “fish wrap”!.....how messed up is this???????

Steph
says:
03/07/2013 at 03:23
A Top University? Designed either by a first year undergrad or someone in the commercial arm, definately not an independent, academic trained in research. Bet that didn’t go through Ethics Committee. Suggest someone contact Ethics Committee at Waterloo and check out the panel’s view?

Steph's Logic
says:
03/07/2013 at 03:25
If this is ‘real’ research run with University approval, it would have gone through the Ethics Committee first. Suggest someone check this out?

See more
says:
03/07/2013 at 03:57
This looks like job App. For CANWEA !!! Go figger ! When do you think that we should help the people that are under distress from IWT’s?
(Sorry wrong question!)

Ron Hartlen
says:
03/07/2013 at 07:10
Looks like an attitude / opinion survey designed to get the answer the Government wants. It’s not even “thinly-disguised”; it’s blatantly obvious. Next we’ll hear that the majority of surveys will be distributed in Toronto, because that’s where the majority of Ontarians live. The University of Waterloo appears to have sold it’s soul and it’s reputation for a few $. Complete lack of intellectual integrity and technical competence. Nobody should complete the survey. Just return it with an explanatory note, in ink.

MA
says:
03/07/2013 at 07:40
Come on, people. Don’t you get it? You’re supposed to be obedient sacrificial lambs. You’re supposed to Love the source of your illness. It’s not the turbines making you sick. You’ve just gotten your info from the wrong places (not CanWEA).....you have flawed ideology, that’s all!

Lorrie
says:
03/07/2013 at 08:26

I'd like to know how many versions of the same survey they have on the go. This one is different from the one I saw. U of Waterloo had an opportunity to do something with teeth to address the nightmare from turbine toxic homes people are trying to deal with. Instead they flop around like a fish on land, offer a Samsung TV to any who will participate and ask incredibly insulting questions like:"How satisfied are you with how your body looks?" Are you F kidding me?

> Free Thinker
> says:
> 03/07/2013 at 09:44
> Hey Lorrie,
> Yikes! "How satisfied are you with how your body looks?" '[excerpt] Health Minister Deb Matthews, at the Toronto Centre Rosedale Ontario Early Years Centre Monday for the report's release, said she will chair an inter-ministerial working group that looks at implementation of its recommendations.'
> http://cnews.canoe.ca/CNEWS/Politics/2013/03/04/pf-20627546.html Secular Humanism – anything for your love – baby. Welcome to Ontario!
>
> > ScepticalGord
> > says:
> > 03/07/2013 at 10:22
> > I'd rather take health advice from the svelte Iona Campagnolo than the "lissome" likes of Deb Matthews and Arlene King. Do as I say, not as I am. Jus sayin'.
> >
> > See more
> > says:
> > 03/07/2013 at 21:49
> > Is she the one in the middle ?
> >
> > Sylvan Bob
> > says:
> > 03/07/2013 at 22:08
> > Gord, you wrote, "I'd rather take health advice from the svelte Iona Campagnolo than the "lissome" likes of Deb Matthews and Arlene King. Do as I say, not as I am. Jus sayin'." Could we stick to content and avoid commenting on appearances? You can be large and healthy, you can be skinny and unhealthy. Do you also criticize people with glasses – like me, or does appearance only matter when it's women Could we stick to content and avoid commenting on appearances? You can be large and healthy, you can be skinny and unhealthy. Do you also criticize people with glasses – like me, or does appearance only matter when it's women?
> >
> > ma
> > says:
> > 03/07/2013 at 22:12
> > Thank you Sylvan Bob. This is politics, not a beauty pageant.
> >
> > 1957chev

says:
03/07/2013 at 23:17
Advice to children of Ontario from Deb Mathews: Do as I say....not as I do. Advice to people of Ontario from all Liberals: We want you to believe everything we say, while we cover up what we do. Words... with no wisdom, straight from the den of iniquity.

ScepticalGord
says:
03/08/2013 at 08:21
Nor would George Hamilton be the best choice to lecture teenage girls on the dangers of tanning beds ...

jack
says:
03/07/2013 at 08:27
Junk science, they forgot to ask about how I like the way my newspaper is being delivered IMHO, complete this at your own peril or just mail it back blank with a hunk of your choice of farm animal sh$t attached. Mailed a copy to my MP and MPP and asked if they would please respond and let me know if they would participate in this kind of survey. Hmmmm...Wonder if I'll get a response? Keep your stick on your sign

Havertonian
says:
03/07/2013 at 09:24
In Marketing 101 we are taught that you design the questions on a survey so that the answers you obtain give you the answers you want. Surveys are only carried out to reinforce the position you want to take. That's why surveys always ask Motherhood type questions..e.g., Do you want to live in an unpolluted world? Of course we do. Everybody does.

WillR
says:
03/07/2013 at 09:34
OK This type of Surety is widely used. Go here for a "Replication" of the Lewandowsky Survey: Here is how to view the similar survey — it is much much worse — take it if you like! http://ascottblog.wordpress.com/lewandowsky-survey-replicated/ PASSWORD is the word REPLICATE
Just type it in in all caps and SUBMIT. [grin] There has been considerable discussion about the methodology and data regarding the recent paper "Lewandowsky, S., Oberauer, K., & Gignac, C. E. (in press). NASA faked the moon landing – therefore (climate) science is a hoax: An anatomy of the motivated rejection of science" (copy here) Just so people can see...

WillR
says:
03/07/2013 at 09:40
So that people can fins all/most of the articles regarding the Lewandowsky Survey posted on WUWT — there is a ready made search link here:

http://wattsupwiththat.com/?s=Lewandowsky Remember Stephen Lewandowsky's ridiculous premise: NASA faked the moon landing – therefore (climate) science is a hoax That is (i.e.) if you do not believe in Climate Science — you believe in conspiracy. So if you think the above is bad read up on this... As they point out — it seems more akin to bear-baiting. In social sciences someone starts off with a bad form of questions(s) then people following after are compelled by tradition in the science to use the d\same bad questions so they can compare results over time and geography. A lot of people who "disbelieve in" Green Energy (whatever that is) are treated or thought of in the same way.

WillR
says:
03/07/2013 at 09:43
A good look at Stephen Lewandowsky The people at U of W are strikingly normal by comparison.

WillR
says:
03/07/2013 at 09:49
Stephen Lewandowsky makes fun of people who believe in a "New World Order"... I would like to share with you the best information I have on the the "New World Order". Go here: http://search.un.org/search?ie=utf8&site=un_org&output=xml_no_dtd&client=UN_Website_en&num=10&lr=lang_en&proxystyleshe That's right — the UN website Just Type "New World Order" into the search box — with the quotes and you have several days of yummy reading on various nut-bar theories. What's that you say? It's the UN that started the IPCC — it's them that are pushing "Green Energy"? Oh, wow! Whoodda thunkit?

Sandra
says:
03/09/2013 at 08:19
Google for UNAgenda 21

WillR
says:
03/07/2013 at 10:01
A link to Climate Audit which pulls up the various Lewandowsky Articles where the stats and math behind these types of surveys is explored. Not to mention the ethics and the irritation factor. http://climateaudit.org/?s=Lewandowsky This is not the first survey of this type to raise the ire of "then common folk" — and the odd mathematician or two, some researchers, business people and most with an open mind. The other two dozen or so agree with Dr. Lewandowsky.

WillR
says:
03/08/2013 at 13:40
People may want to review this publication: http://www.who.int/substance_abuse/research_tools/en/english_whoqol.pdf For an example...

WillR
says:
03/08/2013 at 13:43
And the scoring manual: http://www.who.int/mental_health/media/en/620.pdf That might help some people understand — if that is the right way to put it...

WillR
says:
03/08/2013 at 21:11
The material they are using is right out of the World Health Organization Manuals. Check the links. Is WHO unethical? Can you sell that position?

harvey wrightman
says:
03/07/2013 at 11:57
I would guess that no one who lives within a wind project will participate in this "survey." The whole thing drips with condescension and arrogance. I would also guess it will be tweeted all over, just like NexTerror's eagles nest fiasco – lots of Blackberry hits.

Martin
says:
03/07/2013 at 12:42
Some of the leading questions are similar to the ones in the Ont survey looking at FIT regulations. Many of us participated, but I'm sure our comments didn't make it into the final report. This is worse than useless.

Petra
says:
03/07/2013 at 13:08
Sooooo many folks with Ph. D's and THIS is what they come up with? Are we sure they are not all Liberals? The disconnect with this group and your everyday average Joe rural citizen is palpable, just like McWynnty and her colleagues.

1957chev
says:
03/08/2013 at 20:41
I would bet most of them ARE liberals.

Andrew Hoag
says:
03/07/2013 at 19:27
We need a direct email to the one who is responsible for this survey so we can all give them a piece of our minds!!!

1957chev
says:
03/07/2013 at 23:21

Maybe with enough pieces of our minds, they can make one of their own....that actually works.

sandra
says:
03/08/2013 at 07:28
There is and I did.

Linda
says:
03/07/2013 at 20:24
Letters awaaay!
Attention: Professor Bigelow:
pbigelow@uwaterloo.ca
http://www.orc-reth.uwaterloo.ca/Contact/

ma
says:
03/07/2013 at 21:19
Professor Siva Sivoththaman
Faculty of Engineering
Department of Electrical and Computer Engineering
University of Waterloo
200 University Avenue West
Waterloo, Ontario N2L3G1, Canada.
Email:
sivoththaman@uwaterloo.ca

barbara
says:
03/08/2013 at 15:51
Jut more of the “water boys” for IWT industry.

1957chev
says:
03/08/2013 at 20:43
Very well-paid water boys....I’m sure!

suspicious and dismayed
says:
03/08/2013 at 20:53
University of Waterloo Renewable Energy Technologies and Health Research Group
Phil Bigelow, PhD
Steve McColl, PhD
Laurie Hoffman-Goetz, PhD
Jane Law, PhD
Shannon Majowicz, PhD

Siva Sivoththaman, PhD
Mahtab Kamali, PhD
Veronique Boscart, RN, PhD
Leila Jalali, MD
Susan Yates, MSc, RN
Tanya Christidis, MSc
James Lane, MSc Candidate
Samriti Mishra, MSc Candidate
Claire Paller, MSc Candidate
Tanya Christidis (Project Coordinator) at the University of Waterloo 1-519-888-4567 ext. 31342 or tchristi @uwaterloo.ca
Should you have any comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin, Director of the Office of Research Ethics, at 1-519-888-4567, ext. 36005 or maureen.nummelin@uwaterloo.ca

> WillR
> says:
> 03/08/2013 at 21:09
> I think that this route (Ethics Complaints) is a steep uphill battle. If you look at my posts above you will realize that many of the questions came right out of World Health Organization (WHO) surveys on health. So first you would have to prove that the World Health Organization is unethical. That is a tough one. Who is going to take that seriously — even if it is true? If you want to complain I know they will listen. Make your complaints about specific questions and what you find to be problematic. Suggest another way to get the data. Suggest other wording suggest specific questions to be dropped. No health studies completed? More turbines. It's that simple. Would you like the Doctor who wants to study our genes running the survey? How close to George Orwell's future do we want to go? Everyone complains that there are no credible studies. Wonder why? We are all working at cross-purposes.
>
> > barbara
> > says:
> > 03/08/2013 at 21:29
> > Can you post some of the WHO questions as many people will not bother to look them up to find out what's going on? Seeing is believing!
> >
> > WillR
> > says:
> > 03/09/2013 at 00:01
> > Barbara:
> > If people are being affected by wind turbines it may not be too much to ask them to do a little work. If people find it too much trouble to follow the link it is their decision. People may want to review the questions in this publication: The similarity is striking.
> > http://www.who.int/substance_abuse/research_tools/en/english_whoqol.pdf Just one example of the standard surveys... There are lots more.
> > **********

For an example...
How would you rate your quality of life?
To what extent do you feel that physical pain prevents you from doing what you need to do?
To what extent do you feel your life to be meaningful?
How satisfied are you with yourself?
How satisfied are you with your personal relationships?
****
If they don't use the standard questions and techniques — other academics, doctors and politicians ignore them. If they do use the question we vilify them. Can't win...

barbara
says:
03/09/2013 at 00:06
Thanks, this also provides proof for those who want to deny that this information is true.

WillR
says:
03/09/2013 at 00:11
Here is a book on how to create a survey with sample questions, scoring etc.
http://www.who.int/healthinfo/survey/SAGESurveyManualFinal.pdf

WillR
says:
03/09/2013 at 00:19
Have a look through the search functions as well — here is one search: http://search.who.int/search?q=health+survey+questions+pdf+energy&ie=utf8&site=default_collection&client=_en&proxystylesheet=_ Lots of surveys. Lots of descriptions of surveys. All remarkably similar. I mm not suggesting that people should be happy with the survey. I an not suggesting that we not complain. I am suggesting that we complain in a way that will get things fixed; to get a survey done; and, to defend this rather irritating and useless social experiment called Industrial Wind Turbines. It's not going to happen without this style of work being done. Spending time on "ethics" when it is clearly not going to go anywhere is a waste of time. I spent the time digging into this because I wanted to know if I was told the truth about the questions on the U of W survey were of a standard form. OK! — apparently so. So now let's do something worthwhile with our time. I do a lot of stats work — but of a much "harder" form — not this soft social sciences stuff — I do not have the domain knowledge so I had to start looking — it won't hurt other people to do the same.
Now, we can fix things or we can bellyache. Your call.

harvey wrightman
says:
03/09/2013 at 11:22

This “survey/study” is little more than a copy of work done 10 years ago. We don’t need more surveys to examine the inner turmoil persons/receptors are experiencing. Eja Pedersen and others identified the problem 10 years ago. To do such a survey now is like pulling the wings off a fly to observe its behaviour.

Fed up
says:
03/09/2013 at 09:21
One more question for the test is , how many university reps doing this test love green energy?? No more questions needed.....

WillR
says:
03/10/2013 at 09:28
The only “Green Energy” I know of is the sun shining on the earth — on green leaves, plankton, animals etc. Everyone I know loves that — even windies. Is that what you mean? Beyond that I am not aware of any human created energy source that I could agree is “Green Energy”. Feel free to suggest what might be “Green Energy”. I know of nothing. Not river dams, not pumped storage, windmills, IWT’s solar cells, hydrocarbons (including ethanol). Nothing. Maybe someone could provide a definition of “Green Energy” — it would help us all.

jack
says:
03/10/2013 at 10:03
Another “put down” .....WillR 10 ..... Bloggers 0 give it a rest already

Sandra
says:
03/10/2013 at 09:39
Or equally disturbing–collect data to build less complaint causing turbines. Never mind anything else. Rural Ontario — get used to them. What a joke!

WillR
says:
03/10/2013 at 11:22
Sandra:
That is exactly the intent of the survey and the medical studies. To find a way to reduce complaints — whether the research groups realize it or not — and some do. It is the only reason I can find to oppose the surveys. The IWT’s are an economic disaster and should never be built on those grounds. If they aren’t built they cannot be a nuisance. It is a black joke! — and until our government masters learn some fundamental economics the IWT’s will continue to be built on the basis that our political masters are assisting in the religious movement to save the planet. All praise GAIA! We build in her name! All praise Gaia! Some politicians watched Star Trek far too often in their youth and did not understand the difference between propaganda and science. Yes, get used to them!

Article 3: Wind Concerns Ontario Position Statement on Research Chair

From: http://haldimandwindconcerns.com/?p=962 [7/May/2013 11:14:34 AM] (Hanna, 2011)

Wind Concerns Ontario Position Statement on Research Chair

Posted on November 20, 2011 by tammy

Wind Concerns Ontario has become aware that Siva Sivoththaman PhD, the Research Chair tasked with the assignment of researching the potential adverse health effects of renewable energy mainly wind turbines, and members of his team have begun trying to survey rural Ontario residents and conduct noise measurement studies. **WCO strongly recommends that you do not participate in these activities.**

The Research Chair was established September 2009 and as a result of inaction since then, more Ontarians are suffering adverse health effects without resolution, restitution or official acknowledgement by the Ontario government. Therefore our caution is valid.

Important Facts:

- The Ontario Government has convened and funded the Research Chair [1]
- The Ontario Government is a proponent, financial stakeholder and partner in wind energy development [2]
- MOE developed the Ontario regulations and noise guidelines for wind turbines [3]
- MOE internal correspondence, obtained through a freedom of information request, describes the inadequacies of the Ontario regulations and noises guidelines for wind turbines [4]
- MOE internal correspondence, obtained through a freedom of information request, confirm that Ontario regulations and noises guidelines for wind turbines will or will likely result in adverse effects [5]
- MOE internal correspondence, obtained through a freedom of information request, describes how wind turbine noise has caused adverse effects such as annoyance and sleep disturbance [6]
- MOE internal correspondence, obtained through a freedom of information request, describes how wind turbine noise has made Ontario living conditions which are uninhabitable [7]
- MOE internal correspondence, obtained through a freedom of information request, describes how some Ontario families have abandoned their homes and in some cases have reached financial settlements with the wind developer [8]
- Evidence submitted before a 2011 Environmental Review Tribunal (ERT) by the Director for MOE confirms at the levels experienced at typical receptor distances in Ontario the sound from wind turbines will cause a non-trivial percentage of individuals to be highly annoyed and suffer stress related health impacts [9]
- During the Ontario Environmental Review Tribunal (ERT), witnesses for both the Respondents and/or the Appellants provided evidence and/or testimony which confirm the stress related health impacts of wind turbine noise include symptoms such as sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, nausea, visual blurring, tachycardia, irritability, problems with concentration and memory, and panic attack episodes associated with sensations of internal pulsation or quivering when awake or asleep. MOE has been advised of recently published articles in peer reviewed scientific journals which detail wind turbine adverse health effects in Ontario and elsewhere [10] , [11] , [12], [13]
- The ERT Decision stated wind turbines can harm humans and expressed concerns about the MOE Director's apparent lack of consideration of indirect health effects and the need for further work on the MOE's practice of precaution [14]

- The ERT Decision acknowledges the need for additional research into the health effects of wind turbines [15]
- Despite the above facts the Ontario Government denies there is any evidence of adverse health effects Despite the above facts MOE continues to approve wind turbine projects using their flawed regulations and guidelines [16]

Clearly the Ontario Government convened and funded research would be viewed as a conflict of interest and it is difficult to imagine that research convened and funded by the Ontario Government can be viewed as unbiased and/or objective.

Furthermore without any description of the methodology and stated purpose of the research it will likely be a waste of time.

In Ontario we have a "living laboratory" right now where people are suffering a myriad of serious health complaints. However considering the facts noted above, Wind Concerns Ontario has taken the position that we will not provide the Research Chair or the government of Ontario with lab rats.

Despite the Environmental Review Tribunal testimony by Appellants and Respondents, the Environmental Review Tribunal Decision, internal MOE correspondence obtained from Freedom of Information requests, and peer reviewed articles which confirm individuals reporting adverse effects and in some cases have reached financial settlements with the wind developer, the MOE continues to claim the Ontario Noise Guidelines protect human health and continue to permit wind developments too close to people.

How many people in Ontario have to get sick before the Ontario government and its wind industry partners decide to tell the whole story?

Please feel free to write to Dr. Sivoththaman sivoththaman@uwaterloo.ca or to the Ombudsmanamarin@ombudsman.on.ca

Signed,
Ian Hanna, Chair Wind Concerns Ontario

Posted on
Owen Sound Sun Times
Ontario government has bad policies on wind development

Editor:

In early 2010 the McGuinty government signed a $7-billion energy deal with Samsung Energy Corporation of South Korea.

Around the same time the Ministry of the Environment appointed Dr. Siva Sivoththaman of Waterloo University to do research on renewable energy technologies and potential health effects from wind turbines.

Dr. Sivoththaman coined the phrase "scientific evidence available to date does not demonstrate a direct cause effect between wind turbine noise and any adverse health effects on people living near wind turbines."

Opponents of wind energy want a doctor for the independent health study, not a professor of engineering. A report released on May 20, 2010 by the same minister of health– Dr. Arlene King– used the same coined phrase by Dr. Sivoththaman.

Dr. King also stated that the Ontario wind turbine setback of 550 metres is consistent with the World Health Organization (WHO) nighttime noise guideline of 40 decibels for the protection of human health.

In my opinion, the WHO rec-o mmends a buffer zone of 2,000m and the French Academy of Medicine suggests no less than 1,500m due to health concerns. On March 19 The Sun Times read "Turbines part of health study." Funding is being provided by the Ontario Ministry of the Environment which allocated $5 million over five years. Dr. Sivoththaman along with Dr. Cunningham of Queen's University and Dr. Suresh Narine of Trent University, will spearhead the government sanctioned study into the safety of renewable energy and its health effects. Dr. Hazel Lynn, Grey Bruce medical officer of health welcomed the news. It was her recommendation that this kind of research be done by a university or research institute which is non-biased and they have the expertise to do it. In my opinion, Dr. Sivoththaman is the same doctor appointed back in Feb. 22, 2010 by the Liberal government.

On Sept 17, 2010 a letter from the Minister of Energy Brad Duguid to Ontario Power Authority chief executive officer Colin Anderson giving details on how Samsung will provide 2,500 megawatts of wind and solar power, including manufacturing plants for power components. Duguid directed Hydro One to hold in reserve 500 megawatts of 1500 transmission capacity to be made available for the Bruce area, in anticipation of the completion of the Bruce-Milton transmission reinforcement grid. Another 500 megawatts has been set aside for Haldimand County, Essex and Chatham-Kent areas.

Mike Sapiro, president of H.A.L. T (Huron Kinloss Against Lakeshore Turbines) said "the Samsung deal has angered trading partners in Japan and the United States.

The "Samsung deal is guaranteed, so they are looking to buy out other companies with leases.

Six Nations chief Bill Montour said "the business models did not connect. Sign this deal and trust us." This agreement was intended to be part of the $7 billion contract between Ontario and Samsung. The deal was called off, now the company is headed towards Crown Land with the help of the Ministry of Natural Resources.

Newly elected chief Scott Lee (Chippewas of Nawash Unceded First Nation of Cape Croker) and chief Randall Kahgee (Saugeen Ojibway Nation) have jointly studied and ruled out wind energy as a potential source of economic development. In a news release, the McGuinty government is to follow through on its commitment to resource benefits sharing with the aboriginal communities by setting aside $30 million. This agenda includes the Green Energy Act and the Mining Act. I applaud the First Nation, Inuit, Metis peoples for not trading money for the health of their communities.

It is obvious that the McGuinty government has grossly incompetent policies — the health tax, E-Health, carbon tax, Smart Meters, HST, Green Energy Act and exorbitant hydro bills and in the past three years a $52 billion debt.

The health study will be short lived and renewable energy projects will flood this beautiful province.

I don't trust this government, even after the approval of the health study. It has approved two more Fit-in Tariff lists for renewable energy projects — instead of putting a moratorium on all energy projects.
Joseph Leung Annan

Appendix H: Examples of citizen emails received regarding RETH Survey remuneration

Some emails have been edited for brevity (i.e. removal of email and listserv footers/signature lines, addition of consistent spacing for readers, removal of extra carriage returns, and removal of redundancies) and anonymity (all names and identifying features from senders have been removed). All content edits have been noted. Edits to formatting have not.

DUFFERIN COUNTY: Enter our University of Waterloo 'study' and win a SAMSUNG TV

(name withheld by researchers) Tue, Nov 27, 2012 at 8:35 AM
To: tchristi@uwaterloo.ca

Tanya,

The entire University of Waterloo 'study' has been *off the mark* since the beginning but this tactic sinks to a new low. How can Mr. Bigalow or Mr. Sivothaman expect anyone but the wind industry who also uses such tactics, to give any credibility to your study, using the term study very loosely in this case?

(name withheld by researchers)

(location withheld by researchers)

www.windvigilance.com

N.B. This email included "Fill in a wind turbine health survey, WIN a Samsung tablet (!?)" article included in Appendix F below

Disgusting

(name withheld by researchers) Tue, Nov 27, 2012 at 7:13 AM
To: tchristi@uwaterloo.ca

U of Waterloo Wind Turbine Study:

Offering a Samsung prize to wind turbine neighbours? How insensitive can you be? That's like offered a BP logo hat to the people working to clean up the Gulf of Mexico!

Samsung is decimating rural Ontario with it huge wind turbine projects. Samsung entered into a sweetheart deal with this government and it's failed Green Energy Act.

Shame on this short-sighted department. Your bias is definitely showing.

(name withheld by researchers)
(location withheld by researchers)

(name withheld by researchers) Tue, Nov 27, 2012 at 7:35 AM
Reply-To: *(name withheld by researchers)*
To: *(name withheld by researchers)*, "tchristi@uwaterloo.ca" <tchristi@uwaterloo.ca>
Cc: Ontario Wind Resistance <ontario-wind-resistance@googlegroups.com>

Samsung = backroom deals with Smitherman = dirty business and now free gifts from our government. (the study is government funded)
Is it not unethical to offer a prize for something as serious as asking for health information?
Is it not unethical to offer a "prize" to innocent people right before Christmas?
Do you think maybe some folk will try to do what the surveyors want in hopes of winning the prize....right before Christmas?
This is incredible.

Tanya Christidis <tchristi@uwaterloo.ca> Tue, Nov 27, 2012 at 9:29 AM
To: *(name withheld by researchers)*

Hi *(name withheld by researchers)*
Thank you for bringing this to my attention. This was an honest mistake on our part and now that this has been brought to our attention we will definitely not use a product from Samsung as a token of appreciation for participants.
Thanks
-Tanya

(name withheld by researchers) Tue, Nov 27, 2012 at 9:30 AM
To: ssanti@uwaterloo.ca, maureen.nummelin@uwaterloo.ca, dgdixon@uwaterloo.ca, president@uwaterloo.ca, tchristi@uwaterloo.ca

U of Waterloo Wind Turbine Study:

Offering a Samsung prize to wind turbine neighbours? How insensitive can you be? That's like offering a BP logo hat to the people working to clean up the Gulf of Mexico!

Samsung is decimating rural Ontario with it huge wind turbine projects. (Samsung Tries to Buy off Neighbours to Bypass Regulations) Samsung entered into a sweetheart deal with this government and it's failed Green Energy Act under very questionable circumstances.

Careful, your bias is definitely showing.

I would like to know how much Samsung is paying to fund this study (behind the scenes)?

(name withheld by researchers)
(location withheld by researchers)

(name withheld by researchers) Tue, Nov 27, 2012 at 9:33 AM
To: Tanya Christidis <tchristi@uwaterloo.ca>

Thank you for the response but your department obviously hasn't a clue to what has been going on in rural Ontario. It shows sheer ignorance of the situation more than "an honest mistake". People are absolutely furious. The emails are flying around like crazy.

I just sent another email with a link to what we are dealing with.

Again, thank you for responding.

(name withheld by researchers)

Samsung Galaxy tablet

(name withheld by researchers) Tue, Nov 27, 2012 at 4:03 PM
To: tchristi@uwaterloo.ca, pbigelow@uwaterloo.ca

Is it gross insensitivity or total incompetence that would lead you to offer a Samsung Galaxy tablet as an inducement to participate in your Quality of Life and Renewable Energy Technologies Study in Dufferin County????

If you don't know what I am talking about, then you had better figure it out fast, as your totally inappropriate choice of this offer is colouring the acceptance and credibility of your study. I cannot believe you would be so blatantly crass in your choice of inducement! Is Samsung funding this prize? Does that not seem unethical to you? Or are your ethics not at the same level as everyone else's.

This is incredible!

(name withheld by researchers)

is there bias in the Quality of Life and Renewable Energy Technologies Study???

(name withheld by researchers) Tue, Nov 27, 2012 at 3:27 PM
To: tchristi@uwaterloo.ca, ssanti@uwaterloo.ca, maureen.nummelin@uwaterloo.ca, dgdixon@uwaterloo.ca, president@uwaterloo.ca

Good afternoon,

As an alumnus, it was disappointing to hear that UW is trying to distribute Samsung Galaxy tablets to those experiencing sleep disturbance and/or other effects of wind turbine noise, pulsing, vibrations, infrasound or low-frequency sound.

Associating this study with Samsung products looks bad for these reasons:

1. Bias: It makes it look like the study is biased toward a wind turbine company (Samsung)
2. Bad PR: It's insensitive to the participants of the study to be supporting one of the companies that may be causing the health impacts being studied

I would like to suggest:

1. Substituting the Samsung product with any other product
2. Cancelling the draw: I'm sure that residents are more interested in resolving their health issues
3. Not using Samsung products in any UW department for the duration of the Quality of Life and Renewable Energy Technologies Study to avoid the appearance of bias

What is the source of the Samsung products? It would look bad on UW to be accepting gifts from a wind turbine company to do a study related to wind turbines. Obviously, this would be a clear conflict of interest.

I await your answer to this question,

(name withheld by researchers)

Appendix I: Member Check Materials

Dear participant,

Thank you again for taking the time to be interviewed for this study.

This document includes an interpretation of the themes that we found when analysing the interviews and we are sharing it with you today to undergo a process called "member-checking". This step of the process is not always performed, but is a cornerstone of strong interview-based research since it helps to limit researcher bias in the interpretations. Given the divisive nature of wind turbine development we felt that it was the right choice for this research study. We're hoping that you're interested in sharing a few more minutes of your time to provide feedback on these preliminary findings.

Please read over the following document while considering: **are the findings consistent with the way the issue is understood in the community?** You may not agree with all of the content – we did meet with a variety of people with different views – but we want to make sure that we've accurately captured the issues surrounding wind turbine development in Ontario. Also be aware that the representative quotations that follow and illustrate each theme may only highlight a small aspect of the theme.

We ask that you provide your comments by filling out the feedback form also attached to the email. Please let us know if you'd prefer a paper copy to be mailed to you or if you would like to communicate your feedback through a phone call.

Feel free to contact Tanya Christidis if you have any questions. We ask that comments be submitted to the researcher by February 25th, 2016.

Thank you,

Tanya Christidis, Ph.D. Candidate, School of Planning, tchristi@uwaterloo.ca

Dr. Phil Bigelow, Co-supervisor, School of Public Health and Health Systems

Dr. Geoff Lewis, Co-supervisor, School of Planning

TOPIC 1: Experiences with wind turbine development

1) **LANDSCAPE:** The impact of wind turbines on the landscape was important to both new and long-term residents. In most cases, these residents felt that the landscape was an important part of their home and quality of life and that wind turbine developments had a negative impact on the landscape.

   "…they didn't care that the enjoyment of my property has been diminished. I'm quite lucky compared to some people because I can still look south but I can't look north. I don't walk anymore to the north because they're everywhere."

2) **ECONOMIC IMPACTS:** There was disagreement over the economic impacts of wind turbines which varied from job creation, property values, tourism, and amenity agreements (any funding or investments from the developer to the municipality).

   "The headlines 'Wind company gives city $1.2 million over 10 years for their local improvement fund' you know. We call it outright bribery."

   Those who are not receiving economic benefits were more likely to be concerned about reduced property values and perceive amenity agreements as bribery. Those who benefit from the development were more likely to focus on the potential for positive economic benefits for the community, for example, residents with wind turbines on their property or

politicians who have access to significant community funding as a result of the amenity agreements.

"The municipality's struggling with dealing with a whole range of financial issues and here's, here's a ton of money coming in every year that is brand new… the majority of people, I don't think they care at all frankly and, and if they do think about it, if they watch municipal affairs – which again is a very small, very small group of people – they probably think, 'You made a pretty good deal.' "

3) **HEALTH EFFECTS:** Health effects remain a concern among many participants. There was agreement that a small portion of the community was impacted but there was disagreement as to what the source of the health effects was. Those who were opponents of wind turbines generally felt it was a direct impact from wind turbine exposure while those who were not opponents generally felt it was more of a psychological issue.

"That's a tough one to explain, ok? I feel a sensation, like a vibration internally, in my head and, you know, some people would say, "It's just in your head," right? No. But no, I feel it and, yeah, again it's hard to describe. I feel that certain sensation, you know, which is sometimes very uncomfortable and, yeah, I, believe me, I've tried to describe it a few times and it's really hard to describe. It's not a pounding in my head or anything like that, it's just this uncomfortable vibrating sensation which is internal"

"I would say you're talking a few percent of the people, not, not that many but—but you know, it's hard to determine whether that's, you know, true really physical health effects or if it's just a psychological thing because people are so angry that when they look out their window they now see all these sticks sticking up from the ground in front of their picture window. So, you know, it might, might wear on their minds a little bit and any little thing that they feel sick over has probably been caused by the wind towers."

TOPIC 2: Wind energy development: who, where, why, and how

1) **OPINIONS OF WIND:** The advantages and disadvantages of wind turbines were weighed differently by participants and were not universally agreed upon. Some participants acknowledged strengths and weaknesses and ultimately decided that there was a net positive effect. Those who did not approve of wind turbine development seemed to rebut all possible positive aspects of wind energy found in the general discourse.

   "Like, they're really not green. When you look at how much carbon dioxide they put into the, into the environment and, you know, how they talk about carbon footprints, well they'll never erase their carbon footprints because they aren't going to produce enough energy to erase the ore that was mined and shipped to China, that they made into iron, to be shipped back to, to put these things in, and, you know, the lost production on the land that was out of production while the wind turbines were being built."

   "I mean, any source of energy, there's always, there could be negative impacts but it's always a balancing act. And when I go into a house and I turn the light switch on I like to see light, and if I want to do that I have to be prepared to get the energy from some source. And if I'm going to look out my back window I would much sooner see a wind turbine than a nuclear plant."

2) **OPINIONS OF OTHER ENERGY OPTIONS:** There was a general understanding that every energy source has advantages and disadvantages but among opponents this understanding did not seem to be extended to wind energy. These conflicting viewpoints are evident in communities near Bruce Power, with many residents accepting the inherent risk of nuclear energy and the possible benefits of choosing to host nuclear waste but considering the shortcomings of wind energy to be unacceptable.

   "I don't think at any time during that 50 years that we ever had the types of complaints about health effects that we have had about just this one turbine here at C.A.W. And I

think it's part of it is, I always say it's, you know, it's your family member, it's your brother, your cousin, your uncle, your neighbour that works there, they come home every day and they're all very highly trained people so I think there's a better understanding of nuclear power in our community than there is probably 50 miles away where you don't see that. And there's no question it brings enormous economic benefit."

"None of them [other energy sources] bother me as long as they don't interfere with my life. Like, if I'm starting to get a little irradiation and my dog's getting sores on it then I got an issue…. I live [near a] wind turbine that has potential to keep me awake all night and give me vertigo so, I'll live by any of them except wind."

3) **INEQUALITIES IN OUTCOMES:** A general theme was perceived inequality, with residents living among wind turbines placing themselves on the losing end. The 'winners' in these circumstances are neighbours who chose to develop on their property, other residents within the county who do not live nearby but who benefit from the amenity agreements, urban residents of Ontario, and developers that are large international corporations.

"[there have been]…major divisions in the community and I don't think they'll ever heal. And when you have a small community that's just devastating, it really is. There are the people who signed up and, and then there are the people who are opposed, and we tried as much as we could to not, to not be divisive in this but it's inevitable."

"If somebody decides to take one for the team on their own, great, good for them. But if you, you can't force people to take one for the team."

4) **RURAL VS. URBAN ONTARIO:** The perceived division between rural/Conservative-voting Ontario and urban/Liberal-voting Ontario was discussed in many of the interviews. Some participants feel that the Liberal government is more willing to place undesirable developments in communities where votes are not needed to win a majority government.

"…when you're in downtown Toronto and you think you're doing green energy well, "Hey isn't that wonderful. Yeah, I support the Wynne government. They're going to do green energy, oh yeah we need that, we're running out of renewables. Oh my gosh." … But, you know, they think it's great and, and the Liberal government of course is looking at the vote situation and they know they're safe cause there, there aren't enough of us in the rural areas to overwhelm the, the city people, the population."

Others felt that the wind turbine opposition was being used by the Conservatives as a partisan wedge issue. Regardless of behind-the-scenes political decisions, it does appear that wind turbine development has served to intensify perceived divides between rural and urban Ontario.

"Everybody in rural communities thinks that we're on this one way street that looks like a subway, you know, subway tracks. So, you in Goderich are powering Toronto and Toronto can't generate any of its own power and they need to take it from everywhere else in the province so we're all feeding this big machine from an electricity standpoint. People don't, don't seem to understand that it is an up and down grid. It is made of many components in many different areas and it all goes into one big system – comes in, goes out, it flows. Electricity flows in many different directions. People don't understand that; they think that they, that once again, the benefit of Toronto is on the backs of the rural communities."

5) **SITE SELECTION:** There were differing statements in terms of where opponents would like to see development. Few opponents feel as if their community is appropriate for wind turbine development. For example, a person from a rural agricultural landscape may suggest that a rural forested landscape would be more appropriate, yet the opposite point of view would also be voiced. Similarly, a rural person might suggest that an urban landscape would

be better suited for development, and the reverse would also be suggested. These are natural reactions to an unwanted development.

"…it's so interesting this business of whether a turbine is an appropriate, like, what kind of impact, visual impact, how does it disrupt relationships in a landscape. Well, it may not disrupt relationships so much in most of the southern Ontario agricultural landscape which is highly industrialized, right?"

"I say why not build them around big cities – they're already, there's already so much building and what not going on, like, why destroy all these beautiful natural areas where people, I guess like me, like to go to escape what's going on in the city, and it seems to be getting harder and harder to do that, and that's a real shame I think."

TOPIC 3: Improvements to decision making processes and implementation of wind in the future

1) **MUNICIPAL INPUT:** Most participants agree that limiting the role of the municipality was fundamental for the extensive wind turbine development that has taken place in Ontario. Those who were opposed to wind turbines saw this as unjust policy and those who were not opposed saw this as a necessary policy for reaching a collective goal.

"I wouldn't even call them approvals because as you know municipalities have very limited approval other than, you know, impact on the roads, providing entrance permits, issuing building permits for the, for the pedestal, for the base of the turbine, but no approval at all over whether turbines are going to be here or not."

"I, I think that, that more local and municipal consultation should be required as part of the process of screening potential development locations, but I, I personally, given, given our experience here over the last eight years, I personally don't think the ultimate veto power shouldn't rest with the municipality….And I hope that doesn't sound like I'm kind

of passing the buck but, but I think there are decisions around things like energy in our province that, that have to be made for the bigger public good. And I believe that's what the province has been trying to do – I do give them credit for trying – with green energy alternatives."

2) **COMMUNITY-MEMBER INPUT:** Regardless of personal opinions of the turbines, residents, politicians, and developers agreed that community members have not been engaged in a meaningful way. This is difficult to mandate as there is no incentive for developers to do anything beyond the minimum required consultation and it is difficult to quantify engagement.

"…those meetings, the community meetings were decreed by the provincial government as a way to consult. But because the government put in legislation that you have to have public meetings, the developers thought that was the only way to go and the only way to do consultation. So it was very rare that we would have meetings with specific opposition groups in a smaller setting where we could address those specific problems and questions. I think that the meetings themselves were highly antagonistic across the board."

"I think you can consult but if those concerns aren't addressed and there's a sense that there's an active disregard for those concerns and when tied to the parameters of the legislation it, it breeds frustration in communities where, yeah, sure, you know, we had meetings, you know, and we got to get up at a mike and talk about what our concerns were but, you know, that was it. So they, you know, if they're simply mandated to hold public meetings and make public announcements without any real, tangible triggers to address concerns then it's all for nought."

3) **DEVELOPER TRANSPARENCY:** Many residents described significant distrust of developers as a result of actions that took place leading up to wind turbine development. These actions were seen as a predatory. There is a need for transparent negotiations with community members and straightforward contracts.

"…they in effect said to people, "You need to sign a confidentiality agreement because we don't want our competition to know what we are doing and we don't them to know how much we're paying per turbine, to have, to potentially have turbines on your land, so you have to keep this quiet." But that's what they said but also in doing it meant that they could go from house to house to house with, with people not being aware of what their neighbour had done or even talking to their neighbour in any way, shape, or form in regard to this."

"…for most people in this area there is not a high level of education, there's not a, a substantial income. Most of them I would say would have read very few contracts in their day. So for this company coming in to sign people up to leases it was like shooting fish in a barrel."

4) **LOCAL OWNERSHIP:** Few participants agreed that local or public ownership would improve acceptance of wind turbine development. However, many participants showed contempt for the profits gained by large corporations, implying that this may be an important factor.

"I do think there would have been a lot less squawking and a lot less, like, it would have been a less – I don't know how much less – but a less contentious issue, wind power in general. If it was still Ontario Hydro, and Ontario Hydro – See, because everybody back then, rural Ontario too was just used to, "If Ontario Hydro says they're putting a big power line down our road, they're putting a big power line down our road and we can't do anything about it."

"…the concept of a cooperative at least makes it a little bit more tolerable in that the, the towers presumably are located on properties where the property owner is involved somehow as well as neighbours in the vicinity who would be potential beneficiaries from, from the income from the development … I could see that model being good in terms of people at least not saying, "Well it's some big offshore corporation that's deriving all the income on the backs of we poor folks here" in whatever community it is."

5) **COMPENSATION:** Many participants living near wind turbines described decreased quality of life, decreased property values, and concerns over property rights and felt that these issues require acknowledgement in some form. Some participants felt that compensation would be appropriate.

"I can't just sell it for two hundred, which I put into it and find another place for two hundred because it's no longer two hundred, so I mean compensation would be great so that I would then have the choice to sell it and move somewhere else."

"One huge issue is if, if you and I had adjoining farms and you wanted or were offered a turbine on your property and it was, it met all the right distances and everything but in five years I change my crops and I wanted to bring in offshore workers and put a bunkhouse in the back of my property I couldn't do it because of your turbine. Huge issue. Like you get locked in by what your neighbour did on your farm with no recourse."

6) **RISK COMMUNICATION:** A small minority of respondents reported health impacts from wind turbines. Many participants had never experienced health effects but were anxious about exposure to wind turbines. Although the volume of research on this topic is still modest, improvements to risk communication would likely decrease anxieties. Risk communication messages could address possible risks, the limits of current scientific knowledge, and how an acceptable level of risk is determined.

"I think today's standard is still a minimum of 550 metres from a residence that's not on the property where the, the turbine is located. And perhaps that should be increased, for example, to 750 metres. Is there science to support that? No, I'm not sure there is, but it would, it would perhaps go a long ways to alleviating concerns of, of those folks that, that feel even at 550 metres they can hear it too much or they feel it too much or their sensitivity is still affected by them."

"You have to prove harm to this, you have to prove harm to that, but yet there has been no studies done, there's absolutely no scientific evidence to show that wind turbines don't cause harm to human health and yet we have to fight something that's never been done."

Please provide your comments by filling out the feedback form

Feedback form: Understanding support and opposition to wind turbine development and assessing possible steps for future development

We ask that you provide feedback by filling out this form. Please return these comments in a way that is convenient for you. We suggest digital comments or handwriting notes to a printed copy of the document and sending us a scan. Please let us know if you'd prefer a paper copy to be mailed to you or if you would like to communicate your feedback through a phone call. Feel free to contact Tanya (tchristi@uwaterloo.ca) if you have any questions. We ask that comments be submitted to the researcher by February 25th, 2016.

My opinions are represented on these pages (circle or highlight one option):

Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree

Please comment further: