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Review of Wind Turbine Regulations Public Engagement

APRIL 2022

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municipality of cumberland

Credits

This report was prepared by planning staff of the Municipality of Cumberland in consultation with the residents of Cumberland County, wind turbine proponents and various government agencies. We greatly appreciate people taking the time to talk with us and sharing their concerns, ideas and vision.

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FORWARD

The Municipality is grateful for the time taken by so many people to provide input on wind turbine regulations. Over 200 responses were received at the time of preparing this report.

Responses were received with a wide variety of questions, concerns, statements, and opinions. About a third of the responses were specific to a wind farm proposal in the Wentworth area. Many responses likely originate from those residing outside Cumberland County however, no attempt was made to isolate or identify non-Cumberland responses.

Nearly half of the responses used one of several form letters, some simply added their name while others added additional responses. While such form letters do an excellent job of hitting a wide variety of possible concerns there is no way to know if the respondent in fact agrees completely with the content of the letter or is more generally supporting the overall cause as they see it. Regardless of the format in which the responses were received, the volume of such form letters adds a weight that is undeniable. While some individual responses were very brief and may have only raised one or two issues others were lengthy, well written and presented and were a delight to read. All, however, provide valuable insight and help tailoring wind energy policy to Cumberland.

INTRODUCTION

In the summer of 2021, the Municipality of Cumberland Bylaw Committee raised concerns on wind turbines requesting planning staff prepare a report on wind turbine regulations, specifically, setbacks, decommissioning practices, and approval options comparing Cumberland regulations with those of other municipalities. That review concluded:

> *"It would certainly appear that there is room to improve wind development regulations in Cumberland. Requiring noise studies and possibly approval by Development Agreement have the potential to provide more detailed controls and better public involvement. Separation distances also deserve a closer examination along with decommissioning requirements".*

On December 22, 2021, Municipal Council put a moratorium in place on new wind turbines while it conducts a review of wind turbine regulations.

Public engagement is an essential element in any planning exercise as it gives the public and other stakeholders a voice and identifies concerns and questions. For this review, Ads were placed in the *Cumberland Wire* on February second and ninth and in the *Chronicle Herald on February* third. Notice was also placed on the Municipality of Cumberland and PlanCumberland websites along with posts on Facebook and Twitter. These ads and notices informed the public that Council is reviewing wind turbine regulations and invited submissions by email or regular mail.

We have tried to reflect responses as accurately as possible, using quotes to express the varied opinions offered by respondents and apologise in advance if any appear to be used out of context or if the quotes do not always align with the variety of sentiments provided. Responses were also received from three wind proponents: the Canadian Renewable Energy Association (CANREA) and the Nova Scotia Dept. of Natural Resources and Renewables. The purpose of this report is to provide an overview of the input people so graciously took the time and effort to provide.

Comments spoke to several aspects of wind turbines:

- Public Engagement and communications.
- Economic benefits. Increased taxes, the need for greater local benefit and possible impacts on tourism.
- Concerns related to the siting of turbines including impacts on lifestyle, environmental impact, wildlife habitat and visual impacts.
- The need to displace fossil fuels and reduce our electrical dependence.
- Wind energy as a necessary response to climate change.
- The necessity of appropriate regulatory requirements and the importance of good processes.
- Post-construction operations and maintenance including issues related to monitoring, accountability, and a complaints process.
  Decommissioning of turbines at the end of their useful life.

WHAT WE HEARD

Public Engagement

While public engagement was not a major area of concern by respondents, some concerns were raised. Some people felt that the local community needs a stronger voice in the decision-making process. Others felt that there was a lack of communication from wind energy proponents. Others simply advocated for public engagement as part of a more robust approval process. There was also criticism with the current review being undertaken at a time many seasonal Cumberland residents are at their permanent residence. Yet others were satisfied with communications and engagement both as part of this review process and with proponents.

Sample Comments from Respondents:

- *The developer has consulted extensively with the community, incorporated feedback, and implemented real change in scale and turbine placement to minimize visual and sound impacts.*
- *The [Provincial] EA process for wind developers suggests community engagement and participation in planning for Wind Farms but it is a) not a requirement and b) no standard of consultation is established. Further the EA process itself is woeful in terms of avenues and process for citizen participation to inform the ministerial decision.*
- *I feel that the company has done a good job in reaching out to the community, and I am happy with their response to community concerns about the visual impact of the farm.*
- *A clear issue in this particular consultation process and in consultations undertaken by the Municipality in general has been the propensity to call for consultation when seasonal residents are not in residence. Seasonal residents have significant investments and do pay taxes. Better consultation requirements and mechanisms must be established to ensure that seasonal residents have the opportunity to participate in discussions that affect their investments and the quite enjoyment of their properties.*

Economic Benefits

The majority of responses focused on the theme of the economic benefits of wind development. Those who were focused on a potential wind farm in the Wentworth area commonly mentioned a lack of a local economic benefit, many pointed out that the primary landowner for that project is a large multi-national with headquarters in Indonesia meaning lease revenues would not only be leaving the community where the wind development was situated, but the country as well. This same group are concerned that large wind developments would diminish nearby property values and hurt the local economy by making it less attractive for four-season eco-tourism and have made calls for assistance in developing a tourism strategy.

Other responses see wind turbines as a benefit to both the local economy through jobs, lease payments and community benefits packages as well as a significant source of tax dollars. Several responses suggest a more positive correlation between wind energy and eco-tourism.

Sample Comments from Respondents:

- *Cumberland Municipality should consider a special zoning bylaw to protect areas that are important to its residential, tourism, socioeconomic, and wilderness uniqueness.*
- *The proposed wind turbine projects could seriously impact future nature-based tourism development in an area that is known for its outdoors.*
- *Marketing the region as [an] eco-friendly tourist destination is not incongruent with the presence of wind turbines; rather it demonstrates true commitment. There is a considerable body of literature that reveals little evidence that wind developments are linked to negative tourist experiences.*
- *My concern is that by placing an extremely large-scale industrial wind farm on or beside this wilderness area, the enjoyment of the natural beauty will be diminished and that tourism operators may have a more difficult time selling the natural beauty experience if it becomes overshadowed by an industrial energy installation.*
- *Wind turbines and tourism are not mutually exclusive. There is no evidence that the tourism elements of the Wentworth valley would be impacted by turbines.*
- *The developer has promised significant financial support for the local economy via a community benefits fund, as well as contracting and employment opportunities for local people and businesses. This is in addition to over $20 million in tax revenues estimated over the life of the project.*

Siting of Wind Projects

It can be challenging to separate siting concerns from regulatory, health, environment, and visual impact as they are so intertwined. This report looks at siting mostly at the larger community scale rather than the exact placement of a particular turbine. This includes certain large scale concerns such as wildlife corridors and visual impact while concerns related to noise, shadow flicker and setbacks are dealt with separately.

A common theme for the responses, particularly concerned with the Wentworth area, was that it was the wrong area for turbines. People voiced concerns on how the turbines would have a negative impact on enjoyment of the land and their quality of life. Others pointed to two recent reports on mainland moose https://novascotia.ca/natr/wildlife/species-at-risk/#moose which identify Wentworth (and most of Cumberland County) as core moose habitat.

Some have commented on the importance of accounting for the visual impact of wind turbines and suggest the provincial environmental assessment (EA) process does not include enough guidance on the issue. Other respondents have a different opinion and suggest turbines have a more neutral or even positive visual impact on the landscape.

Sample Comments from Respondents:

- *I am not opposed to green energy, but I feel strongly that wind projects should be placed as strategically far away from populations as possible.*
- *These are projects currently proposed and do not reflect future proposals that would further the risk to the environment and quality of life in our communities.*
- *Climate change has been linked to extreme temperatures and increasing forest fires that will cause much more destruction to local biodiversity than the installation of wind turbines.*

- *It is my opinion that the projects being proposed would ruin what I consider to be a natural provincial treasure.*
- *Wind Farms are a « get green quick » trick that do not take into consideration the damage caused by construction & transport of the turbines themselves, damage to the forest and all who live in them - especially the bird migrations and Moose corridor contained in the proposed area, damage to the health of those who live near these giant 'farms', and damage to the growing tourism industry for the County.*
- *We are very concerned that the windmills would forever taint the natural beauty and enjoyment of this area.*
- *We feel strongly that although we support windmills in theory they should be placed in remote areas where they won't harm wildlife, residential and adventure areas.*
- *Visual sightlines are a recognized area of concern in an Environmental Assessment for wind projects in Nova Scotia. However, the province does not offer much in the way of regulation and guidance for projects such as this.*
- *Wentworth Valley is a discrete area of outstanding natural beauty and a recreational resource of great provincial value. While I am very much in support of the continued transition to sustainable and renewal energy sources, I view Wentworth Valley alongside other provincial sites, such as Peggy's Cove, Kejimkujik and the Cabot Trail, that need to be preserved in the most natural state possible, and the addition of an industrial wind turbine development would be an open wound on a treasured provincial asset.*
- *The proposal appears to include due consideration for the environment and even takes care to preserve sight lines as much as possible. Personally, I consider the sight of turbines a sign of hope, not a blight on the scenery.*
- *The Hart Lake Cottage and homeowners' association … agree that the RES submission for mega sized wind mills should never be allowed within 20 kilometers of any residential area. …There is plenty of land to be built on far away from people's homes and communities.*
- *Given the vast area of Cumberland County, there must be other areas less impactful to communities that would be conducive to the installation of a wind farm.*
- *"Not in my backyard " mentality should not be an argument for opposing these projects.*
- *I do not feel that a wind farm project is incompatible with this natural beauty. I believe that we must invest in projects like wind farms in order to ensure the future of our environment. I am honestly tired of the "not in my backyard" voices who support environmental causes as long as they are not visible to them. The Wentworth Valley is a natural fit for a project like this. I hope to see this project proceed.*
- *Prohibit industrial wind turbines in areas of important moose habitat and connectivity in Colchester/ Cumberland.*
- *Enact Protection of the mainland moose core habitat designated in Colchester/Cumberland, in the Nova Scotia Mainland Moose Recovery Plan.*
- *I feel a bit hypocritical being in opposition. In some ways, I am the definition of a NIMBY... but I truly believe that my reasons for opposing this plan are in the interest of the greater community of residents and seasonal visitors.*

Appropriate Regulatory Requirements

Many people, regardless of their stance on wind turbines express appreciation in having the opportunity to provide input. Similarly, several people commented on the review process itself highlighting its importance and the need do it right. Not surprisingly there were also comments critical of the six month moratorium on wind turbine approvals.

Some people felt that the municipal approval process should be changed to be considered by a committee, other responses suggested that approval occur by Development Agreement. Zoning was yet another tool recommended by several respondents. Some felt that zoning could be a useful tool to either distinguish between smaller wind turbines and larger turbines/wind farms or to determine where wind turbines are not allowed.

One of the wind turbine developers has pointed out that wind projects demand large amounts of time, financial resources, consultation, planning, wind measurements, studies and analysis and ask for fair, predictable, and transparent rules and processes. Another suggests that if zoning is used that it would be best achieved by zone restrictions, excluding certain sensitive areas. Another suggested that if development agreements are used that they are not layered on top of zoning limitations and that they do not interfere with the provincial EA process and that the two processes be permitted to run concurrently.

Sample Comments from Respondents:

- *It worries me to see that Cumberland County is pausing wind energy development permits for 6 months to a year to review its bylaws. Any further delays or roadblocks to renewable energy adaptation will potentially cause the provincial target to slip away, and it is of utmost importance to ensure that good wind energy projects can still proceed.*
- *The issues of adequate setbacks, decommissioning, accountability, future protections and a robust decision-making process are all critically important in any bylaw revisions.*
- *Pausing wind energy developments, even for 6 months, is a step backwards in a forward moving society. Claims that wildlife are affected by wind turbines have been shown to be unfounded. Perhaps it is that better programs are needed to educate the public.*
- *The County should not allow these larger installations to be as-of-right under the by-law. Instead, the by-law should take a development agreement approach towards wind farms and large turbine installations.*
- *We would recommend the County maintain development permits issued as-of-right with special requirements. This provides developers with fair, predictable and transparent rules and processes. This will minimize the ability of specific interest groups to have undue influence over the development of good projects.*
- *As Cumberland County revises its wind farm regulations, it should actively set out zoning that distinguishes requirements for industrial wind developments vs smaller wind turbine initiatives (such as might be put in by a single farm or other small business, or resident).*
- *The County has a once in a generation opportunity to create a framework for better projects should they go forward. Proponents will work within those frameworks regardless how difficult they might seem. … Don't simply tweak your rules. Instead create a higher ground whereby if projects are built, they do not divide us by failure but rather then unite us in success.*
- *Zoning areas where wind development should not be allowed due to residential, tourism, socioeconomic, historical or cultural or indigenous reasons.*
- *In the interest of accountability to the community, there should be a Review Committee comprised of the Development Officer, members of Council, the planning department and the public before granting approval to any wind project.*

Health & Noise Concerns

A number of responses raise concerns on possible impacts of turbines on physical or mental health of residents. Many of these raise general concerns of the turbines while others are more specific and identify, noise, glint, shadow flicker as possible health concerns. There were also a large number of responses that tied health in a more direct way to turbines suggesting that they would interfere with the ability to enjoy the peace and mental health benefits offered by unspoiled wilderness.

One of the form letters forwarded by over fifty residents requests a noise limit of 25 dB as measured at existing residences. And points to a 1999 study by the World Health Organisation (WHO) which recommends 30dB for rural settings. It was clarified in a follow-up email that the 30dB recommendation by the WHO "was a measurement for inside (bedrooms)."
A large number of emails, primarily focused on the Wentworth area copy the same 25dB recommendation along with the misquote of the WHO.

Several of the wind turbine developers point to current requirements in the provincial EA process and suggest that they are adequate and accurate and are worst-case scenarios.

Sample Comments from Respondents:

- *Studies confirm more research is required into health and mental effects of industrial wind turbine projects from noise, ruined scenic views, and flicker. Light pollution impacts include; stress, anxiety, sleep disturbance, nausea and dizziness.*
- *The relationship between wind turbines and human health has little to no correlation.*
- *Damages could take the form of negative impacts to health, diminished property values, and environment.*
- *It is required through the EA process in NS that this pre-construction sound level modelling demonstrate that the sound levels at nearby residences are not expected to exceed 40 dB(A) under worst case conditions. This modelling is industry standardized, uses turbine manufacturer specifications, and has been shown to produce reliable results.*
- *Some residents near wind turbine projects in NS have had to move and sell their property at a loss to escape the loud noises and flickering. Others, who have stayed, live with migraines, nausea, and anxiety daily due to no recourse through their county.*
- *Nova Scotia Environment and Labour has established that "the proponent must ensure that the wind farm design and turbine siting does not cause sound levels to exceed 40 dBA (A-weighted decibels) at the exterior of receptors.", which is in line with industry best practices.*
- *Being the largest county by land mass in Nova Scotia I feel we have an obligation to do our part for the future and make a statement while doing so.*

Environmental Concerns

There are two distinct camps evident in the responses regarding environmental concerns. One the one hand there are many responses that advocate the use of wind turbines as part of an environmental solution and alternative to the mining of and burning of coal and other fossil fuels. This group suggests that in light of the climate change emergency, Cumberland needs to be part of the solution and has highlighted Nova Scotia's recent commitment of supplying 80 per cent of the province's electricity using renewables by

2030, reducing emissions to at least 53 per cent below 2005 levels by 2030, and achieving net zero by 2050.

An alternate view is shared by a similar number of respondents that are concerned with the environmental impact of the turbines in general and raise particular concerns with mainland moose habitat and general habitat loss and degradation. Less common were concerns about water quality and other environmental impacts related to turbine construction.

Sample Comments from Respondents:

- *No one likes change – I understand that. As humans, for the most part, we resist it, even when all signs point to change as the best choice. You are our leaders, we are relying on you to make the best choice, even if some of us don't see it – yet. We will all see the impacts if we do not change.*
- *In no way should pristine lands with high wilderness and recreational value be risked to a venture that may well supply power for export.*
- *Please take this opportunity to shift Cumberland from an extractive economy mindset with all its plunder and destruction to a regenerative economy that emphasizes social and economic vibrancy, advances ecological restoration, and builds a thriving local community.*
- *I strongly urge Council to focus on the larger picture of reducing carbon emissions and objectively judge the impact of wind farm development.*
- *I'm sure you are aware that Nova Scotia has committed to reducing our greenhouse gas emissions by 53 percent below 2005 levels by 2030; this includes transitioning 80% of all electricity generation in Nova Scotia to renewable energy. Making this goal a reality and living up to our climate change commitments requires our elected officials to stand behind low-cost renewable energy projects that will displace fossil fuels and bring Nova Scotia the cleaner energy we need.*
- *I would strongly encourage that the County to recognize the dire implications to its natural ecosystems and wildness areas if climate change is permitted to go unchecked.*
- *There are implications with these massive wind turbines including but not limited to wildlife degradation, endangered species, huge environmental concerns, interference with all aspects of telecommunication services, and general disregard for the citizens and visitors in this area for the peace and enjoyment of the land, and economic development.*
- *We are facing a climate emergency as has been declared by Cumberland County, Amherst as well as Halifax and hundreds of other municipalities across North America. Recent weather events globally and locally (last week's extensive flooding and road closures) should leave no doubt that Climate Change is a real and growing emergency for our county. An emergency is a time of action when we accept that imperfect situations are unavoidable and we make difficult decisions that are for the benefit of society and the benefit of future generations. An emergency is a time when leaders take responsibility for their citizens and lead.*

Setbacks

Of those who commented on setbacks, the majority consider the current setbacks inadequate and have recommended setbacks from 2-3km to as large as 20km from dwellings or residential areas. The most common suggestion was a setback of 5 km which was shared by nearly fifty responses whose concerns largely are focused on the Wentworth, Hart Lake area. The typical reasoning for larger setbacks is to minimise noise, health concerns and to avoid interference with the peaceful enjoyment of outdoor activities. At least one response suggested different setbacks for wind farms versus individual turbines and that the setback increase with the overall size of the development.

Setbacks were also addressed by several of the wind turbine developers. Some point out that the noise, and shadow-flicker limitations in the provincial EA process usually require larger effective setbacks than the 600m in the current Land Use Bylaw. Others have cautioned that large setbacks are not feasible and that a 2km setback would eliminate wind turbines from most areas in Cumberland County and suggest that the current regulations are in line with industry best practice and are more restrictive than locations such as Quebec and Ontario.

Sample Comments from Respondents:

- *This setback request of 5000 meters is the most critical ask. This should ensure there are no issues to residents and visitors for sound (audible and infra), flicker, views, ice throw and other physical and mental health concerns.*
- *Setbacks must not just protect existing properties from the disturbance and negative effects of being too close to industrial wind turbines, but potential developments must be protected too.*
- *Any impacts from potential noise or shadow flicker can be easily mitigated by appropriate setbacks to homes.*
- *The present 600m setback regulation in Cumberland is not adequate especially now with the bigger turbines. Many reports recommend a 2km setback.*
- *We recommend that the County's minimum setback between wind turbines and habitable buildings not located on project lands leased by the project be 1 km or less. It is important to note that based on the Cumberland Wind Energy Development Plan, the maps "…clearly showed that increasing setbacks to 2000m from the nearest dwelling would virtually eliminate any areas for development of large-scale wind projects."*
- *Unless neighbouring landowners are willing to allow a variance, I would suggest that a 2 km setback to property lines for large industrial turbines would be reasonable and prudent.*
- *Current setback regulations are woefully inadequate for the giant turbines proposed now and into the future. We should look to the experience of jurisdictions where industrial turbines have had longer history- both positive and negative. We should listen to experts in the field, engineers, acoustics experts and those with the lived experience of having wind turbines nearby We should aim for best in class, 5 km being where countries with more experience are heading.*
- *Setbacks [from habitable buildings] are often included in By-laws, but it's important to understand that their effects are limited since proponents in Nova Scotia must meet the provincial requirements for sound and shadow flicker, which are typically more restrictive than the 600 m distance.*

Operations, Maintenance and Oversight

Roughly half of the respondents see a need for oversight and accountability following the erection of wind turbines. Some suggest that inspections be carried out by qualified professionals to ensure turbines are built and located as the permit indicates. At least half a dozen responses suggested the need for ongoing monitoring or reporting with an equal number recommending some type of complaint process.

Many respondents also called for the creation of a community protection fund, held in trust by the Municipality to be paid out to those who suffer damages from failure to meet regulatory requirements for sound, shadow flicker etc. or from loss in property value.

Yet others are satisfied with the provincial EA process and do not see the need for additional or overlapping regulations. Wind developers suggest that equipment certification and operation procedures are better positioned to ensure minimized risks than restrictive Municipal regulations.

Sample Comments from Respondents:

- *There should be site inspections done by a qualified surveyor or engineer to ensure that each wind turbine conforms to the approved site plan. These site inspections should be done throughout the construction process - prior to and after the pouring of concrete as well as the installation of the turbines. Inspection reports should be posted for the public record.*
- *The residents of the Municipality of Cumberland should be protected by a Community Protection Fund established by the proponent. This Fund could be a percentage of the project cost and would be held by the Municipality. The purpose of this Fund would be to adjudicate and pay out claimants who establish that they have suffered damage as a result of the failing to meet the stringent standards that the bylaws put forth regarding setback, flicker, noise etc.*
- *There is a lot of misinformation on the internet about wind-power, which is feeding some people's fear of the unknown and their resistance to change. This is unfortunate. The county should take notice of environmental assessments which are conducted by professionals, rather than be persuaded by the perceived fears of some of the public.*
- *These projects should be subject to payment of a one percent per annum of revenue contribution to a locally managed legacy fund to be used exclusively for the development of future recreational infrastructure projects in Cumberland County, and that would compensate in some small way for future economic damage.*
- *The mitigation of those risks is not efficiently achieved through restrictive land-use by-law modifications, but rather through rigorous equipment certification and operation procedures, as well as the implementation of an Emergency Preparedness Plan developed in collaboration with the local authorities.*

Decommissioning of turbines

A significant number of respondents expressed concern regarding the decommissioning of turbines, many of which point to existing non-functioning turbines as an example of why such requirements are necessary. Approximately one third of responses suggest bonding as a means of ensuring that the local community, landowner, or Municipality not be stuck

with cleaning up derelict turbines and remediating sites. Several responses raise the spectre of a wind turbine company becoming insolvent and simply walking away from the responsibilities and costs associated with turbine removal and site remediation.

One wind developer suggests that decommissioning and remediation costs are very difficult to estimate decades into the future and sites are most likely to be refurbished at the end of the serviceable life of turbines. They also suggest that if bonding is used that it would be better if it were managed by the province.

Sample Comments from Respondents:

- *Presently there is no requirement for decommissioning bonds to ensure the area is returned to its previous state at end of life. The current three industrial wind turbines in this area linked to one of the proponents have not turned a blade in 3-years and despite being non-conforming to municipal bylaws the tear down or decommission has yet to happen.*
- *Currently, there are five wind turbines in the Wentworth Valley area which have not been functioning for a number of years. All proponents should be required to have a bond in place to cover the costs of decommissioning wind turbines.*
- *I am very concerned that wherever turbines are placed that our municipal regulations lack the teeth to force companies who erect them to tear down these turbines on their own dime once their working life has been completed.*
- *Irrespective of the locations that are chosen for wind turbine installations I feel it is important to have strict legislation in place to minimise the negative environmental impact and ensure responsible operation and ultimately decommissioning.*
- *Who is responsible to dismantle the turbines, under what supervision, at what financial cost to the land owner or county should the turbine company dissolve and walk away.*
- *A Wind Farm typically has an operational life of up to 30 years. The total lifespan depends on various considerations, including the duration of power purchase agreements (PPA), the duration of the permits for operation, and technological restrictions such as wear and tear.*
- *At the end of a PPA or permit term, a Wind Farm Operator may decide to continue operation of the facility, provided that a mechanism to sell the energy produced by the Wind Farm is in place to guarantee future revenue and ensure operational viability, and if permits for operation are extended or renewed, as necessary.*
- *Rigorous decommissioning strategies using 3rd party bonds. Real rules and [teeth] in the bylaws for decommissioning.*
- *If a decommissioning bond is required, it would be helpful to ensure that the bond is managed by the province alleviating the burden of coordinating and managing such funds at the municipal level.*
- *The wind farm owners might become insolvent and leave the turbines standing without maintenance, leaving potentially dangerous and/or eyesores standing.*
- *For wind energy projects, it is often that the value of the scrap metal will cover the cost of the decommissioning, but it is in the interest of the utility and the developer to refurbish the project to continue production beyond the initial Power Purchase Agreement.*

A final word about comments

Often a report such as this will include numerous graphs and pie charts visualising the frequency of various comments or stances. This report has been purposely vague for the most part for three important reasons. Firstly, this was not a survey or conducted with any framework from which we could make such comparisons.

Secondly is the use of form responses. With approximately half of the responses as form letters, concerns that might otherwise be marginal are repeated in each copy giving the impression that each of the concerns identified in each of the form letters is of equal weight which definitely skews results.

Thirdly, those who felt strongly enough about the issue to respond were a self-selecting group, not random or necessarily representative of the population. This does not lessen their value or diminish the concerns raised, it simply means that we can't extrapolate the views provided to the general public. The real value of the feedback provided is identifying key concerns, raising questions and sharing ideas

One of the respondents was Kate Sherren, a professor of environmental and landscape social science in the School for Resource and Environmental Studies at Dalhousie. She explains that …

> *All citizens have the right to be heard in the kinds of decisions that you face as a County, but people are not equally likely to turn out to give their opinion: negative voices may be more prominent than positive ones, but this does not mean they are more prevalent.*

Professor Sherren points to research done with a Master's student, Ellen Chappell, which centred around the wind farm at Amherst, that might provide insight on Council's deliberations. This research surveyed residents of the Sackville, NB, and Amherst, NS, area back in 2018 and provided a good confidence level of (±5.3%, 19 times out of 20).

> *We found attitudes to wind were overall very supportive. Respondents supported wind in general (averaging scores of 4.3 on a scale from 1 to 5 where 3 is neutral, 4 is agree and 5 strongly agree), in the region (4.2) and in view of their homes (3.8). Support declines with proximity but not very steeply, and certainly not as steeply as you'd see in many other jurisdictions.*

The full response from Professor Sherren and the associated research is included in Appendix C.

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March 7, 2022

Sent by email

Dear Nelson,

Municipality of Cumberland Wind Turbine Regulations Land Use Bylaw

The Municipality of Cumberland have been leaders in supporting renewable energy in Nova Scotia for many years. Cumberland is home to several existing wind energy projects, the Fundy Ocean Research Centre for Energy (FORCE) Canada's leading research centre for tidal stream energy, and more recently one of the largest solar energy projects in Nova Scotia. The Municipality's role in regulating wind energy and other renewable energy technologies is key to achieving the goals of the province and we would like to thank you for the opportunity to comment as part Municipality of Cumberland's wind energy land use bylaw review.

The Province of Nova Scotia is working to increase electricity generation from renewable resources. This will help us transition from coal energy, reduce greenhouse gas emissions, and meet our 80% renewable energy targets for 2030. To achieve these goals several new renewable energy procurements are underway. These procurements are driving the increase in wind energy developments throughout the province.

The procurements are being conducted by CustomerFirst Renewables, an independent administrator who is required to conduct a fair, transparent, and competitive process that provides the lowest cost of energy to rate payers. The procurement is a thorough and detailed process and has been designed in consultation with federal and provincial government departments that regulate renewable energy. Projects will be selected based on a set list of criteria that includes energy price, project risk and maturity including permitting and environmental risk, local engagement, and social and economic benefits.

All successful projects must also complete all other federal and provincial approvals and permits to proceed including an Environmental Assessment (EA). EA is a tool used to predict and evaluate the environmental effects of a project before it begins, when there is an opportunity to mitigate potential impacts of the project on the environment. An EA registration document describes the project components, the different phases of the project; construction, operation and decommissioning as well as engagement with the Mi'kmaq and members of the public. The potential impact that the project may have on environmental (including rare species and those at risk), human health (including visual impact, noise levels and shadow flicker), socio-economic, cultural, historical, archaeological, paleontological and architectural features are all considered as part of this process.

To meet the goal of 80% renewable energy by 2030, projects bidding in to the recently launched Rate Based Procurement RFP are required to be fully commissioned and in operation by December 2025. This is an aggressive timeline that provides limited scope for project delays. Projects facing uncertainty in their ability to meet this timeline may not be selected in the RFP process.

Wind energy is currently the lowest cost form of electricity generation for new facilities and brings significant reductions in greenhouse gases. It also provides significant economic development supporting rural economies. New wind energy projects are key for meeting Nova Scotia's future energy needs and the Municipality of Cumberland plays a key role in this energy future. As you review your land use bylaws, we ask that you consider the robust project selection process that has been put in place, the detailed project approval process, the required timelines and local economic development opportunity.

Yours sincerely,

David Miller

Director, Clean Energy

Canadian Renewable Energy Association | Association canadienne de l'énergie renouvelable

Laval, March 2, 2022

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Subject : Wind Turbine Regulations in Land Use Bylaw

The Canadian Renewable Energy Association (CanREA) is the voice for wind energy, solar energy and energy storage solutions that will power Canada's energy future. We work to create the conditions for a modern energy system through stakeholder advocacy and public engagement. Hundreds of communities across Canada have worked with our members to deliver sustainable wind and solar projects across the country. As a result, our members are uniquely positioned to deliver clean, low-cost, reliable, flexible and scalable solutions for Nova Scotia's energy needs that is aligned with the *Environmental Goals and Climate Change Reduction Act* that was adopted recently in the Nova Scotia legislature.

CanREA and its members appreciate and embrace the need to engage with local municipalities, Indigenous Peoples and diverse stakeholders early and consistently whenever a project is proposed. This is the only way to assure that questions are answered, and that completed projects align with community priorities and fit within the local landscape . In this perspective, CanREA remains available to the Municipality of Cumberland to share our perspective on the *Wind Turbine Regulations* on topics like noise, shadow flicker or environmental assessment. CanREA also remains available to discuss the multiple phases of a project from the development phase to the repowering and decommissioning phase, including our promotion of Best Practices in Community and Indigenous Engagement.

We are confident that our industry can provide sustainable projects that would support economic diversification in Cumberland and throughout Nova Scotia as they do across Canada. Effective and meaningful engagement is fundamental to the success of any renewable energy project, and we would be eager to discuss how our industry is continuously improving and strengthening its approaches to respond to the needs of our host communities. Therefore, the Canadian Renewable Energy Association is available to discuss of the *Wind Turbine Regulations* with the Municipality of Cumberland.

In the meantime, please receive my most distinguished well wishes.

Jean Habel

Director, Québec and Atlantic Canada
Canadian Renewable Energy Association

EDF Renewables North America
1010 De la Gauchetiere Ouest, bureau 2000
Montréal, QC H3B 2N2
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Montreal, March 1st, 2022

ATTN:
Nelson Bezanson, Municipal Planner
County of Cumberland, Nova Scotia

Gregory D. Herrett, Chief Administrative Officer
County of Cumberland, Nova Scotia

Subject: Comments on the Land-Use By-Law Revision for Large-Scale Wind Turbines

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Dear Mr. Bezanson & Mr. Herrett,

EDF Renewables (EDFR) acknowledges and respects the Council's decision to initiate a review of its by-law following some concerns expressed by the community about proposed wind farms in the County. We understand that the community may have questions and concerns regarding the development of wind energy facilities, and acknowledge the benefits of clear, transparent, and predictable requirements that guide their development, construction, and operations.

In this letter, we respectfully submit our comments about the on-going revision and provide additional information about our development activities in the County of Cumberland.

General Context

Since 2011, EDFR has been developing a wind energy project, the Yorkshire Renewable Energy Centre (the "Project"), in the County of Cumberland. The proposed wind energy Project will generate up to 84 megawatts (MW) of electricity and will consist of up to 16 turbines. If awarded with an opportunity to execute a Power Purchase Agreement (PPA) with Nova Scotia Power Inc. as a result of the upcoming Rate Base Procurement Request for Proposal (RFP), EDF Renewables will develop, construct and operate the Project, located approximately 10 km southeast of Amherst in Cumberland County, Nova Scotia.

EDF Renewables identified the Project area considering its good potential for wind energy development and the strong interest from local landowners. In 2017, the project was included in Emera's submission in response to the Massachusetts' Renewable Energy RFP. Their submission was unfortunately not successful, but EDF Renewables kept the Yorkshire Renewable Energy Centre active for future development opportunities. The imminent Rate Base Procurement RFP in Nova Scotia is a unique opportunity to accelerate the energy transition toward

renewable energy at the Provincial scale and we think that the Project is well positioned to be successful in this procurement.

EDFR hosted a public meeting at the Leicester Fire Hall on December 13th, 2021. All landowners within two kilometers from the preliminary project boundary received a notice by mail to inform them about this opportunity to learn more about our project. We believe that this event was a success given the good turnout and overall positive response from the public.

If the Yorkshire Project is selected through the RFP process, the **economic benefits for the region** would be significant:

- **Taxation Revenue for the Municipality**
  - Approximately $630,000 for the first year of operation.
  - $15.75 M over the 25-years life of the project.
- **Host Community Benefits Agreement**
  - Administered by local officials & representatives.
  - $50,000 per annum, $1.25 M over the 25-years life of the project.
- **Private Landowner Revenue**
  - Approximately $440,000 annually, $11 M over the life of the project.
- **Job Creation**
  - Construction Phase: More than 150 construction jobs at the peak of construction.
  - Operation Phase: 4-5 full time jobs from within the community to support and service the facility over the life of the project.
- **Local Investment**
  - Significant investment into the local economy during the development, construction and operation phases of the project

A review of setback distances

We understand that the County initiated a review of the separation distances between large-scale wind turbines and existing infrastructures or property limits. Table 1 provides the distances currently in the By-law.

Table 1 - Wind Turbine Separation Distances in current by-law

From	Distance
(a) Habitable buildings external to the wind energy project	600 metres or 3 times the height of the turbine, whichever is larger
(b) Habitable buildings internal to the wind energy project	1.25 times the height of the turbine

(c) Property lines external to the wind energy project	1.1 times the height of the turbine, or height of the turbine plus 7.5 metres, whichever is larger
(d) Property lines internal to the wind energy project	None
(e) Streets and railway rights-of-way	1.1 times the height of the turbine, or height of the turbine plus 7.5 metres, whichever is larger
(f) Natural gas pipeline rights-of-way	85 m
(g) Small- and large-scale wind turbines external to the wind energy project, including wind turbines that have a valid development permit but have not yet been constructed	4 times the height of the proposed wind turbine or 4 times the height of the wind turbine external to the wind energy project, whichever is larger

EDFR confirms that the setback distances are still in line with the industry best practices (IBP) and often more conservative than other locations, such as Ontario or Quebec.

- Setbacks (a) and (b) are often included in By-laws, but it's important to understand that their effects are limited since proponents in Nova Scotia must meet the provincial requirements for sound and shadow flicker, which are typically more restrictive than the 600 m distance**. EDFR does not see a need to modify this distance.**
- For item (c), a setback based on the height of the turbines, like the one in place now, significantly limits the development of new wind projects because the turbines are taller than before. A typical setback from non-participating property lines seen in other jurisdictions is equal to the length of the proposed turbine blade + 10 m when a waiver agreement is in place with the neighboring landowner. **We recommend that, when proponents have waiver agreements on hand with neighboring non-participant landowner, the setback required be reduced to the length of the blade + 10m, as described above.**

Sound and Shadow Flicker Modelling

Nova Scotia Environment and Labour has established that "*the proponent must ensure that the wind farm design and turbine siting does not cause sound levels to exceed 40 dBA (A-weighted decibels) at the exterior of receptors."* [1], which is in line with industry best practices. They have also established that "*proponents must demonstrate through modelling that no receptor will receive 30 minutes or more per day, and/or 30 hours or more per year of shadow flicker*." [1].

Based on modelling completed for our site, the Nova Scotia Environment and Labour requirements on Sound and Shadow Flicker Modelling are more restrictive than the separation distance from habitable buildings in the current by-law, and we therefore do not see a need to adjust the values.

Turbine certification

EDFR recognizes that, **although extremely rare**, there is a risk of equipment failure associated with the presence of wind turbines in a given region. Events such as the collapse of a wind turbine at the Kent Hills Wind Farm in New Brunswick (2021), or the turbine that catched fire at a wind farm in West Pubnico, Nova Scotia

(2019), are highly unusual and unfortunate, but all efforts necessary towards the mitigation of those risks must be undertaken. However, EDFR believes that the mitigation of those risks is not efficiently achieved through restrictive land-use by-law modifications, but rather through rigorous equipment certification and operation procedures, as well as the implementation of an Emergency Preparedness Plan developed in collaboration with the local authorities.

Wind turbines are subject to a rigorous design and testing certification process under the IEC 61400 standard series which includes, among other things:

- Ensuring that Wind turbines have a safety system completely independent of the control system.
- Full scale strength testing of the blades; both a static test which confirms that the blade can withstand extreme loads, and a fatigue test which simulates the complete life loading on the blade, thus verifying the blade can also withstand fatigue loads expected over its design life.

This certification is a minimal requirement for the upcoming Rate Base Procurement RFP in Nova Scotia to ensure that all projects selected by the Procurement Administrator are mitigating the equipment failure risks as much as possible. EDFR also recommends the **collaboration of wind energy developers with local fire departments in the preparation of an Emergency Preparedness Plan and in providing the necessary support to ensure that the local authorities are adequately equipped and ready to answer the call**, should an unfortunate situation arise.

Zoning

If the county is interested in limiting the wind energy development to certain areas, we believe it could be best achieved by the implementation of zoning restrictions (e.g. by excluding sensitive areas).

We believe that the agro-forestry land use near West Leicester is an appropriate region for future wind energy development and that the economic benefits for the community and landowners would be significant.

Decommissioning

Context

A Wind Farm typically has an operational life of up to 30 years. The total lifespan depends on various considerations, including the duration of power purchase agreements (PPA), the duration of the permits for operation, and technological restrictions such as wear and tear.

At the end of a PPA or permit term, a Wind Farm Operator may decide to continue operation of the facility, provided that a mechanism to sell the energy produced by the Wind Farm is in place to guarantee future revenue and ensure operational viability, and if permits for operation are extended or renewed, as necessary. This may also require a partial or complete repowering of the facility. Fully repowering a Wind Farm refers to a situation where all the old turbines would be removed and replaced by new turbines. The components of the wind turbines

(the tower, the nacelle and blades) and the project substation are modular items that allow for ease of disassembly during decommissioning.

Preparation of a Decommissioning Plan

At EDFR, we believe that a decommissioning plan should be prepared for wind farms as an industry best practice. The plan should be completed before the commissioning of the project and should describe how the Wind Farm Operator proposes to both dismantle the wind farm infrastructure and restore the wind farm site to a clean and safe condition that is suitable for future land use.

Content of a Decommissioning Plan

A Decommissioning Plan should include the following sections:

- Overview of the intent and purpose of the Decommissioning Plan, including the land use, function and operability that will exist upon decommissioning as a result of the activities outlined within the Decommissioning Plan;
- Description of Wind Farm Infrastructure;
- Description of the regulatory requirements for decommissioning and restoration (as applicable);
- Procedures for dismantling or demolishing components of the Wind Farm and restoring the land;
- Procedures for managing excess materials and waste;
- Estimation of costs for decommissioning and Wind Farm restoration, including assumptions used by the Engineer;
- Financial assurance instruments:
    - Most financial assurance requirements for Wind Farms within North America provide flexibility with regards to the type of financial assurance instrument used (e.g. Letter of credit).
    - Based on EDFR's experience in other Canadian Provinces, here's what we suggest:
        - At COD, EDFR would submit a security for the dismantlement of its wind farm. The Municipality and EDFR would first co-select an independent expert to assess the expected net costs of dismantling. EDFR would then post the determined amount in security under the form of a Letter of Credit or a Parent Company guarantee.
    - As corporate citizens, it is good practice to provide financial assurance to guarantee that sufficient funds will be available at the End of Operations to properly complete the decommissioning of the facility. This promotes and builds trust with landowners, the surrounding community and the applicable regulatory authorities.
- Implementation timeline.

The content of the Decommissioning Plan will vary slightly depending on the pre-existing land use or another suitable land use (e.g., agriculture, grazing, forest, or open space) that was previously agreed to with the landowner or regulatory agency.

In sum, EDFR believes that the best way for the Municipality to avoid problems surrounding project decommissioning is to ask developers to submit a security at the Commercial Operating Date (COD) for the dismantlement of their wind projects. The amount required for that security would be project specific and evaluated by a neutral third party, like it is done in other jurisdictions such as Quebec.

If you have any questions about this submission, please feel free to contact me at Jerome.dagenais@edf-re.com

Jérôme Dagenais
Development Coordinator
Jerome.Dagenais@edf-re.com

M: 1-514-772-0310

References: [1] *Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia*, May 2007 (Revised October 2021). https://novascotia.ca/nse/ea/docs/EA.Guide-Proponents-WindPowerProjects.pdf.

Dear Mr. Bezanson,

I am writing on behalf of Higgins Mountain Wind Farm Limited Partnership (HMWFLP). We are developing the Higgins Mountain Wind Farm, a 100 MW project on the border of Cumberland and Colchester Counties.

Cumberland has historically been a County supportive of wind power development and hosts many of the successful wind developments of Nova Scotia. Owing to a strong wind resource, expansive rural land base, key interconnection infrastructure, and broad-based community support, the County has attracted a lot of interest from the wind development community.

The first goal of Cumberland County's Regional Energy Strategy is to "position and promote Cumberland County as a strategic location for investment and attraction in the renewable and alternative energy sector that increases the capacity of tidal, wind, geothermal, solar, coal bed methane, etc." The creation of the Cumberland Wind Energy Development Plan was seen as the first step to implementing its Regional Energy Strategy. Through extensive consultation, research, and analysis, the County's Wind Energy Development Plan set out a comprehensive strategy to encourage wind energy projects in the area.

Wind energy developers pay attention to plans like this. Cumberland's wind energy policy is part of the reason many developers, including HMWFLP, have invested considerably in wind development in the County. This includes large amounts of time, financial resources, consultation, planning, wind measurements, studies and analysis. We have consulted early and often, by forming a Community Liaison Committee in 2019, meeting regularly with community stakeholders, and making significant adjustments to our wind farm to mitigate community concerns.

What developers want most is to be treated fairly, with rules that are predictable and transparent. While the recent decision to pause development permit intake has caused heightened uncertainty, we ask that the County's revised bylaw focus on maintaining fairness, predictability and transparency.

Currently, the County is hearing vocal concern from a group called Protect Wentworth Valley. While we agree wholeheartedly with people's right to express their views and contribute to the project's development process, we have seen that much noise and commotion can be generated by a small handful of well-funded and well-organized opponents.

We ask the County to look beyond the rhetoric and focus on fact-based information, just as was done when developing the Wind Energy Development Plan and related bylaw amendments. While the County should absolutely gather input from its residents, when considering wind development, proper weight also needs to be given to information and evidence provided by experts. This includes best practices for turbine siting and environmental, social, and economic issues of public interest. We also feel strongly that the County should be proactively consulting with the renewable energy industry in this process.

We have the following specific comments in relation to the County's bylaw review:

- **Setbacks:**
    - We recommend that the County's minimum setback between wind turbines and habitable buildings not located on project lands leased by the project be 1 km or less.

- It is important to note that based on the Cumberland Wind Energy Development Plan, the maps "…clearly showed that increasing setbacks to 2000m from the nearest dwelling would virtually eliminate any areas for development of large-scale wind projects."
- It appears as though a 2 km of greater setback would therefore be prohibitive to new development.
- While the Higgins Wind Farm minimum setbacks exceed 2 km, we strongly encourage the County to keep its minimum setbacks closer at 1 km or less.

- **Environmental Assessment (EA):**
  - The provincial EA process is comprehensive and encompasses community and First Nations consultation, visual, noise, shadow flicker, socioeconomic, archaeological, historic land use, vegetation, and water (wetlands, watercourses, groundwater etc.), wildlife considerations (i.e., birds, bats, moose, etc.), construction, and decommissioning.
  - When an Environment Assessment is registered municipal governments are notified and can provide input in the review process.
  - The province has the expertise, rules, and standards, to govern these areas of development.
  - It is our recommendation that the County does not create its own redundant or overlapping requirements in its bylaw for matters already covered under Nova Scotia's rigorous EA review process.

- **Wind Turbine Overlay:**
  - We are opposed to the County amending the Wind Turbine Restricted Overlay to add the Wentworth Valley as a tourism area as has been requested by Protect Wentworth Valley (https://www.protectwentworthvalley.com/cumberland-bylaws)
  - Wind turbines and tourism are not mutually exclusive. There is no evidence that the tourism elements of the Wentworth valley would be impacted by turbines.

- **As-of-Right:**
  - We would recommend the County maintain development permits issued as-of-right with special requirements.
  - This provides developers with fair, predictable and transparent rules and processes. This will minimize the ability of specific interest groups to have undue influence over the development of good projects.

- **Decommissioning:**
  - We are supportive of the County taking measures to ensure developers and landowners have adequate decommissioning measures in place to protect the community from liabilities associated with wind farm developments.
  - We recommend the County consult with industry, legal, and subject matter experts regarding decommissioning.

We appreciate the opportunity to provide our feedback during the consultation window. If there are opportunities to consult further with the County on this, we would welcome them. We can provide a further comprehensive technical submission with the support of a municipal land use planning consultant should that be of interest.

Lastly, we encourage the County to stick to its six-month timeline to review the wind turbine regulations in order to ensure the renewable projects that Nova Scotia needs are not delayed.

Kind regards,

Dan Eaton, P. Eng
On behalf of Higgins Wind Farm Limited Partnership

Higgins Mountain
Wind Farm

By: Natural Forces
For: Municipality of Cumberland
Date: March 2, 2022
Re: Review of Municipal Regulations Controlling Small and Large Wind Turbines

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Introduction

The Municipality of Cumberland has consistently been an active supporter of the fight against climate change through progressive policy regulating renewable energy projects. In particular, this is apparent in Cumberland with the presence of several successful wind energy projects, including one owned in part by Natural Forces – the Amherst Community Wind Farm. As such, Natural Forces has worked with Cumberland in the past and looks forward to working with staff and Council to responsibly develop more projects in the future.

This memo is in response to the ongoing review of municipal regulations controlling small and large wind turbines in the Municipality of Cumberland. This memo represents the viewpoint of Natural Forces, an independent power producer that develops, constructs, owns, and operates wind projects across Canada. Natural Forces is based out of Halifax with the majority of operational projects located in Atlantic Canada. As such, Natural Forces offers a local industry perspective to consider during the review. This submission is divided into three main sections:

1) Comments on the existing policies pertaining to wind projects in the Municipality of Cumberland;
2) Responses to the content in the memorandum regarding "Wind Turbine Regulations" authored by Nelson Bezanson, Municipal Planner and dated June 15, 2021; and,
3) Comments on the main topics raised in submissions by the public to the Cumberland Council meetings held on December 22, 2021, January 10, 2022, and January 12, 2022 related to the municipal policies on wind development.

In reading these responses, it is important to consider the larger context of wind development in Nova Scotia at this time. Most notably, there are two provincial procurement processes that have been announced to develop more renewable energy in the province. In total, these two processes are set to add 850 MW of renewable energy to the electrical grid, the majority of which is expected to be wind projects. The province is procuring more renewable energy for the Nova Scotia Power grid in order to reach the target of 80% renewable energy on the grid by 2030. The electricity generated by these new projects will largely offset the retirement of coal plants in Nova Scotia. As such, the electricity generated by these new projects will be used to power homes and businesses in Nova Scotia and is not intended for sale to other markets.

It is Natural Forces' belief that the regulation of wind projects is important. Effective regulations are based on accurate information that reflects the need for renewable energy to combat the climate crisis, reflects the need for responsibly developed projects within communities, and reflects current industry standards and practices. Overregulation comes

with the risk of deterring renewable energy development which can affect our effectiveness in addressing the climate crisis.

Natural Forces has mobilized this viewpoint to aid various municipalities in Canada in updating their policies and bylaws to appropriately regulate the development of renewable energy projects and to ultimately lead to fostering support related to renewable energy projects within municipalities, fostering responsible development, and fostering renewable energy development within a region.

With this submission and future conversations, Natural Forces hopes to participate in the by-law review process at the Municipality of Cumberland.

Municipality of Cumberland: Existing Policy

Municipal Planning Strategy

The Municipality of Cumberland Municipal Planning Strategy currently has policy that is supportive of wind development. Comments included in Table 1 are limited to those polices associated with large-scale wind turbines.

Table 1: Natural Forces' comments on existing Municipality of Cumberland Municipal Planning Strategy.

Policy	Natural Forces Comments
Section 4.7: Renewable Energy	
4.7.1 Context Nova Scotia has, in recent years, been moving towards a future where much of the province's electricity needs are supplied by renewable energy, rather than non-renewable sources like coal and oil. The Energy Act requires 40 percent of Nova Scotia's electricity to come from renewable sources—such as hydro, solar, wind, and tidal—by the year 2020. This will have the benefit of reducing local air pollution, reducing our contribution to climate change, and reducing our reliance on fuels imported from other countries. Cumberland has, to date, played an important role in the development of renewable energy generation in Nova Scotia, and will likely continue to do so in the future.	The provincial targets have since been updated to 80% renewable energy by 2030. Cumberland can continue to play an important role in this effort if regulations continue to allow it.
4.7.2 Wind Energy In 2011, the Municipality of Cumberland released its Wind Energy Development Plan, developed with the support of the Union of Nova Scotia Municipalities. Through this project, the Municipality identified areas that are appropriate for wind turbines, and areas that are inappropriate for wind turbines for reasons such as water supply areas or areas of cultural significance. The project also established requirements to help reduce the impact of wind turbines on surrounding communities and natural features. As of 2017, Cumberland hosts three large-scale wind farms at Stevens Mountain, outside of Springhill, and on the	n/a

Tantramar Marshes. Council intends to continue to support the establishment of large-scale wind turbines in appropriate locations, as well as smaller wind turbines for personal and on-site commercial use.	
Policy 4-53: Council shall, through the Land Use By-law, establish a Wind Turbine Restricted Overlay that identifies inappropriate areas for small- and large-scale wind turbines and includes lands such as, but not limited to, drinking water supplies, bird conservation areas, important cultural areas, historic sites, and ecologically-significant lands.	This is a good approach to regulating wind development. The map as included in the Land Use Bylaw is helpful to developers.
Policy 4-54: Council may consider amending the Wind Turbine Restricted Overlay to add locations where a local tourism plan concludes that small- and large-scale wind turbines are not compatible with the goals of the tourism plan.	n/a
Policy 4-55: Council shall, through the Land Use By-law, permit small and large-scale wind turbines in all zones, but shall prohibit small- and large-scale wind turbines on lands covered by the Wind Turbine Restricted Overlay.	This is a good approach to regulating wind development.
Policy 4-56: Council shall, through the Land Use By-law, establish requirements for the design and siting of small- and large-scale wind turbines, and such requirements may include, but are not limited to, separation distances from dwellings and other features, setbacks from property lines, blade clearances, and tower and signage design.	n/a
Policy 4-57: Council shall, through the Land Use By-law, allow for the waiver of separation distances between wind turbines and existing dwellings, and shall permit new dwellings to be built within the separation distance from existing wind turbines.	n/a
Policy 4-58: Council shall, through the Land Use By-law, establish requirements for the information to be provided and process to be followed for permitting, maintenance, and decommissioning of wind turbines.	n/a

Land Use Bylaw

The Municipality of Cumberland Land Use Bylaw permits small and large-scale wind turbines in all zones but not on lands covered by the *Wind Turbine Restricted Overlay*. Wind turbines are approved as-of-right, meaning that there is no public hearing however the approval process does include a notification to adjacent landowners. Applications are reviewed and approved by the Development Officer.

Comments included in Table 2 are limited to those policies associated with large-scale wind turbines.

Table 2: Natural Forces comments on existing Municipality of Cumberland Land Use Bylaw.

<table>
<tr><th>Policy</th><th>Natural Forces Comments</th></tr>
<tr><td colspan="2">3 Development Permitting</td></tr>
<tr><td>3.1 Development Permit
3.1.3 A development permit shall expire within the following time periods from the date issued if the development has not commenced:
(a) Three years for large-scale wind turbines.
(b) Two years for industrial uses.
(c) One year for all other uses.</td><td>The longer period of three years works well for large-scale wind turbine development due to the development and construction timelines for such projects.</td></tr>
<tr><td>3.3 Application Requirements
3.3.7 Development permit applications for small- and large-scale wind turbines must comply with those conditions as found in Section 5.1 of this By-law.</td><td>n/a</td></tr>
<tr><td colspan="2">5 Use Specific Regulations – 5.1 Small- and Large-scale Wind Turbines</td></tr>
<tr><td>Permitted Zones
5.1.1 Small- and large-scale wind turbines shall be permitted in all zones but shall not be permitted on lands covered by the Wind Turbine Restricted Overlay, shown on Schedule F.</td><td>This is a good approach to regulating wind development.</td></tr>
<tr><td>Siting Requirements
5.1.2 There is no lot frontage requirement for wind energy project.</td><td>n/a</td></tr>
<tr><td>Siting Requirements
5.1.3 Small- and large- scale wind turbines shall have the minimum separation distances as outlined in Table 3.
<table>
<tr><th>From</th><th>Minimum Separation Distance</th></tr>
<tr><td>(a) Habitable buildings external to the wind energy project</td><td>600 metres or 3 times the height of the turbine, whichever is larger</td></tr>
<tr><td>(b) Habitable buildings internal to the wind energy project</td><td>1.25 times the height of the turbine</td></tr>
<tr><td>(c) Property lines external to the wind energy project</td><td>1.1 times the height of the turbine, or height of the turbine plus 7.5 metres, whichever is larger</td></tr>
<tr><td>(d) Property lines internal to the wind energy project</td><td>None</td></tr>
<tr><td>(e) Streets and railway rights-of-way</td><td>1.1 times the height of the turbine, or height of the turbine plus 7.5 metres, whichever is larger</td></tr>
<tr><td>(f) Natural gas pipeline rights-of-way</td><td>85 metres</td></tr>
<tr><td>(g) Small- and large-scale wind turbines external to the wind energy project, including wind turbines that have a valid development permit but have not yet been constructed</td><td>4 times the height of the proposed wind turbine or 4 times the height of the wind turbine external to the wind energy project, whichever is larger</td></tr>
</table></td><td>(a) Given that the provincial environmental assessment process has clear requirements on sound levels and shadow flicker at nearby residences, this setback is appropriate. Overall, whichever setback is greater (municipal setback or noise and shadow levels) will need to be respected by the developer while proposing turbine locations.
While industry standard is a setback of 1 km from residences, this is merely a baseline value. Ultimately, the appropriate setback from residences should be determined by the studied sound and shadow flicker levels through the EA process.
(b) n/a
(c) Consider adding the caveat that this can be reduced with the permission of the adjacent landowner. This type of setback is often difficult to adhere to in Nova Scotia where land parcels are often quite small or narrow.
(d) This is appropriate given that land parcels in much of Nova Scotia are quite small and the landowners are already involved in the project.
(e) n/a
(f) The distance between pipelines and wind turbines should be decided between the pipeline company and the developer. There</td></tr>
</table>

	would be different requirements for different pipeline sizes and depth below grade. (g) n/a
Siting Requirements **5.1.4** Notwithstanding Clause 5.1.3 (a), the minimum separation distance from a habitable building external to the wind energy project may be reduced to as low as 1.25 times the height of the turbine with the written consent of all owners of that habitable building.	n/a
Siting Requirements **5.1.5** Notwithstanding Clause 5.1.3 (g), the minimum separation distance from a small- or large-scale wind turbine external to the wind energy project may be waived with the written consent of all owners of the external wind turbine.	n/a
Siting Requirements **5.1.6** Notwithstanding Clause 5.1.3 (a), proposed habitable buildings shall have a minimum separation distance from small- or large-scale wind turbines of 1.25 times the turbine height.	n/a
Siting Requirements **5.1.7** If a wind turbine project is expanded, the expansion shall not be located any closer to new habitable buildings that were permitted by Subsection 5.1.6	n/a
Siting Requirements **5.1.8** There is no limit on the number of small- or large-scale wind turbines in any one area provided all of the turbines meet setback and separation distance requirements.	n/a
Design Requirements **5.1.9** The minimum clearance between the wind turbine blades and the ground shall be 7.5 metres.	n/a
Design Requirements **5.1.10** Small- and large-scale wind turbines shall be finished in a non-reflective, matte finish.	While this aligns with Transport Canada requirements, it is noted that this does represent an overlap with navigation safety requirements.
Design Requirements **5.1.11** Small- and large-scale wind turbines shall be protected from unauthorized access by a security fence with a lockable gate and a minimum height of 1.8 metres, or by having any ladder or permanent tower access device located no closer to the ground than 3.7 metres or, for monopole designs, by securing access with a lockable door.	This aligns with typical modern turbine design, which are largely monopole and have a secure lockable door.
Design Requirements **5.1.12** Small- and large-scale wind turbines shall not be provided with artificial lighting except for lighting that is needed to meet Transport Canada or other regulatory requirements.	This is standard. The assumption here is that this does not apply to lighting at the base of the tower for safety and security, which is regulated under 5.1.13.
Design Requirements	n/a

5.1.13 Security and site lighting shall not be intrusive and shall be directed so that they do not reflect onto adjacent properties.	
Design Requirements **5.1.14** Small- and large-scale wind turbine towers shall not contain any commercial advertising; however, the hub or nacelle may display the name or logo of the manufacturer, owner, and/or operator.	n/a
Design Requirements **5.1.15** Site signs shall be limited to those that identify the wind energy project, locate access points, and provide safety information.	n/a
Design Requirements **5.1.16** All outdoor storage associated with a wind energy project shall be screened from view from adjacent properties and streets.	n/a
Operation and Decommissioning Requirements **5.1.17** Facilities for the assessment of wind energy resources (test towers) may be erected for the life of the wind energy project. Otherwise, they shall be removed within one year of inactivity.	n/a
Operation and Decommissioning Requirements **5.1.18** If a small- or large-scale wind turbine or wind energy project discontinues power production for 12 continuous months the operator shall provide the Municipality with a status report identifying future plans for the site.	n/a
Operation and Decommissioning Requirements **5.1.19** In accordance with the decommissioning plan, all above ground components of the large-scale wind turbine or the wind energy project, including all buildings and storage facilities, wind turbines wind testing facilities and above ground accessory infrastructure (such as overhead transmission lines and substation) shall be removed from the site (unless, in the opinion of the Development Officer, it can reasonably established that there is another probable near term future use for any of the said components) and the applicable surface site areas, except for roads, shall be restored to a reasonable natural state within 18 months of the time at which the wind turbines cease to produce power continuously for a period of 6 months or, in a case where construction of the large scale wind turbine or wind power project is not completed, the time at which the development of the wind power project ceases.	n/a

Permit Application Requirements **5.1.20** In addition to all information normally required for development permit applications, applications for development permits for small- or large-scale wind turbines shall be accompanied by the following information: (a) evidence and results of public notification, if conducted; (b) when placed on land in the Agriculture (AG) Zone, evidence of the continued use of prime agricultural land for farm use; (c) evidence of notification to the Department of National Defense, NavCanada, Industry Canada, and the Department of Natural Resources, or any successor bodies, regarding potential radio, telecommunications, radar and seismoacoustic interference, if applicable; (d) copies of documentation required (obstruction clearance form) by Transport Canada, or a successor body, for turbines taller than 30 metres; (e) copies of documentation required by NavCanada, or a successor body, for all turbines within 10 km of an airport or for turbines taller than 30 metres outside the 10 km range; (f) a decommissioning plan; and (g) for large-scale wind turbines, evidence of an agreement enabling the connection of the turbine(s) to the provincial electricity grid.	(a) n/a (b) n/a (c) n/a (d) n/a (e) n/a (f) While this is possible to provide, the planning provided at this early stage of a project is likely to have to change over the lifetime of the project. (g) This requirement is unclear and unreasonable at the Development Permit stage. Often the agreement to connect a project to the grid is achieved through a competitive process as is occurring in NS now. In this case, in order to win the agreement to connect to the grid, developers need to have their permitting in hand. This requirement could limit the ability for proposed projects in Cumberland to be successful. It is important to note that wind projects require a power purchase agreement to move forward, so this would have to be satisfied if the project were to be built anyway.
Permit Application Requirements **5.1.21** The applicant shall also submit a site plan prepared by a qualified individual (e.g. surveyor or engineer) and drawn to scale, showing: (a) the location of all wind turbines and accessory uses; (b) the dimensions and boundaries of all parcels of land; (c) the location of all existing and proposed buildings, structures and uses; (d) proposed alterations to natural features; (e) all required setbacks and separation distances; and (f) the Wind Turbine Restricted Overlay.	The only comment here is that it would be helpful to have the GIS data for the Wind Turbine Restricted Overlay in order to create an accurate site plan.
Permit Application Requirements **5.1.22** The Municipality shall notify all property owners directly bordering the wind energy project site upon issuance of a development permit.	n/a

Comments on "Wind Turbine Regulations" Memorandum

This section pulls excerpts from the "Wind Turbine Regulations" memorandum written by Nelson Bezanson, Municipal Planner at the Municipality of Cumberland for the Bylaw Committee and provides comments on each identified policy approach.

Separation Distance From Dwellings

Excerpt from Memorandum

> *Like Cumberland, many municipalities use a multiplier of the turbine height and a minimum distance, whichever is greater, to determine the minimum distance to dwellings. Guysborough uses 2 times the turbine height while CBRM uses 175m for turbines up to 76m tall plus 1m separation for each additional metre in tower height. Annapolis, Antigonish, Colchester, Pictou and Yarmouth have minimum separation distances that range from 600m to 1000m.*

Natural Forces Comments

While there is no set provincial setback requirement for wind turbines from homes, the shadow flicker and operational sound level limits at nearby homes, and investigation of property values and land uses does factor into the provincial environmental impact assessment. These requirements result in ensuring turbines are proposed at locations that address the potential impacts to nearby homeowners. Ultimately, these provincial requirements address any concerns related to the proximity of wind turbines to residences. It is typical that by meeting the provincial requirements for shadow, sound and land use, the turbine locations will meet and exceed the municipal setbacks. As such, though it is fairly common that municipalities have setback requirements for wind turbines from residences for the purposes of addressing sound, shadow and land use concerns, this is a duplication of provincial requirements. That said, Natural Forces would recommend leaving the setback requirement as currently written in the bylaws, as it does reflect a reasonable minimum setback distance based on extensive experience modelling sound and shadow flicker.

Noise Studies

Excerpt from Memorandum

> *Antigonish, East Hants, Lunenburg and Pictou (Draft) municipalities require noise studies and establish noise limits at property boundaries or nearby dwellings. The typical noise threshold used is 40 decibels or the equivalent noise of a refrigerator running or of a quiet suburban neighbourhood at night.*

Natural Forces Comments

Operational sound levels are considered in the siting and development phase of wind projects and are assessed through the provincial environmental assessment process with the use of proven software modelling. In this way, sound levels are mitigated from the outset of project development. It is required through the EA process in NS that this pre-construction sound level modelling demonstrate that the sound levels at nearby residences are not expected to exceed

40 dB(A) under worst case conditions. This modelling is industry standardized, uses turbine manufacturer specifications, and has been shown to produce reliable results. As such, any pre-construction sound level assessment requirements at the municipal level are a duplication of provincial process.

Post-construction sound monitoring field studies are cumbersome and expensive to developers, and, most importantly, have been shown to be ineffective in assessing sound levels in the way proposed in the land use bylaws of counties like Pictou (draft). The main issue with these studies is that they are ineffective at isolating sound levels from a particular source and have been shown to be variable in accuracy. Specifically, climatic conditions and nearby activity have both been shown to impact accuracy and validity of the measurements.

The sound models used prior to construction of a project have proven to be effective in mitigating the impact of unwanted sound at the nearby residences. However, if there are no issues with the sound levels at nearby residences once the project is operational this type of assessment is unnecessary. If residents do submit complaints about sound levels from the wind project, the first step to be taken is an investigation to understand the conditions during which the complaint was issued. For example, if the residence is upwind of the wind project at the time of the complaint, then the source of the noise that prompted the complaint is likely not the wind project. If the investigation demonstrates that the source of the sound that prompted the complaint is the wind project, then there are various mitigation measures that can be implemented to address the issue, such as additional vegetation to dampen the sound. These are the types of commitments made in the provincial environmental assessment process.

Zone Restrictions

Excerpt from Memorandum

> *Several municipalities (Annapolis, Antigonish, East Hants and Lunenburg) only permit large scale wind turbines in a specific wind energy zone. This would typically trigger a rezoning application for each new development providing additional opportunities for public comment.*

Natural Forces Comments

The current 'as of right' approach in Cumberland is viewed as the most appropriate way to regulate wind development, especially where Cumberland has paired this with a Wind Turbine Restricted Overlay. This approach provides more nuance to the identification of appropriate locations, particularly in a largely rural municipality like Cumberland.

Additionally, while there are different approaches to zone-specific requirements for wind projects, they tend to complicate bylaws in an unnecessary way.

If rezoning is the process chosen for renewable energy projects in the Municipality of Cumberland, it should be able to be completed concurrently with the provincial EA process.

Decommissioning

Excerpt from Memorandum

> *Many Municipalities have no decommissioning requirements at all while others, like Cumberland, require that a decommissioning plan be provided during the application. Colchester authorizes the Development Officer to carry out any work deemed necessary to complete the decommissioning plan if not completed by the owner in a reasonable time, with any costs immediately payable by the owner/operator. Caution is advised on following this example as the Municipal Government Act does not provide such authority to Land Use Bylaws or Development Officers unless provided for in a Development Agreement or similar legal mechanism.*
>
> ***Decommissioning:***
>
> *Decommission costs are difficult to estimate and would be very dependant on turbine size, location and the level of remediation desired. Estimates from other locations in North America would suggest a decommission cost of $30,000 to $120,000 per turbine.*
>
> *The Municipality currently has no authority to force a decommissioning of wind turbines without making application to the Supreme Court of Nova Scotia. There are also concerns that should a wind energy operator cease operation, the only recourse for the Municipality would be to the property owner. A Development Agreement can include requirements for decommissioning and even performance surety or bonding requirements.*
>
> ***Bonding***
>
> *Bonding is a method to protect landowners and taxpayers from bearing the cost of decommissioning if a wind farm owner goes belly-up and walks away from a wind project.*
>
> *While no Canadian examples for the use of bonds could be found, in 2017 Montana passed legislation requiring bonds for wind farms that produce at least 25 megawatts. Bond amounts were based on decommissioning plans that wind facilities are required to provide during project approval. In some other jurisdictions bonding may be required up front upon approval while in other circumstances operators are given a number of years to post such bonds.*
>
> *One of the criticisms of such bonding is that it would appear to create an unfair playing field as other types of energy development may not have the same requirements.*

Natural Forces Comments

A general decommissioning plan can be provided for wind projects; however, it should be noted that timelines and cost estimates are difficult to predict 20 to 40 years from the date of decommissioning. If a decommissioning bond is required, it would be helpful to ensure that the bond is managed by the province alleviating the burden of coordinating and managing such funds at the municipal level. For wind energy projects, it is often that the value of the scrap metal will cover the cost of the decommissioning, but it is in the interest of the utility

and the developer to refurbish the project to continue production beyond the initial Power Purchase Agreement.

Additionally, a plan for decommissioning activities is included in the provincial environmental assessment process. This includes plans to remove infrastructure and restore the site to its previous and/or natural state.

Development Agreements

Excerpt from Memorandum

> *A Development Agreement is a contract between a Municipality and a property owner, detailing the obligations of both parties and specifying the standards and conditions that will govern development of the property. Once signed, a Development Agreement is binding on the parties and their successors.*
>
> *There appears to be a growing trend to approve wind turbines by Development Agreement as they provide a higher level of customization and control not available in other approval methods. East Hants, Guysborough, Luneburg, Queens (Draft LUB), West Hants and Yarmouth all utilize this mechanism in at least some circumstances. A development agreement may include a performance surety or bonding requirements and has the ability to force decommission work.*

Natural Forces Comments

While this is a mechanism that other municipalities use, it is important to note that this adds risk to wind energy projects and can deter developers from developing in a certain municipality.

If this were to be an approach taken in Cumberland, it will be important to consider the following:

1) Development Agreement process to be able to be carried out prior to and/or in parallel with the provincial EA process to allow project timelines to be satisfied;
2) Development Agreement can be with the project developer given that they have permission of the landowners to use their land for the purposes of developing a wind energy project;
3) Allow the project developer to participate in the Development Agreement process as much as possible;
4) Balance the Development Agreement process timeline to allow public participation while also not hindering project development; and
5) Development Agreement process should not be in addition to any future re-zoning requirements.

Responses to Comments from the Public

There have been various comments submitted by members of the public about how the Municipality of Cumberland should regulate the development of wind projects. Natural Forces offers responses to many of these comments below to provide additional context on these topics.

Many of the comments provided address topics that are covered through the provincial environmental assessment process. A provincial environmental assessment is required for any wind energy project that is 2 MW or greater. This includes a public participation process that is advertised locally and province-wide. The environmental assessment includes studies on the various 'valued environmental components' (VECs) associated with the existing environment prior to the development of the wind project. These components include the biophysical, physical, and socioeconomic factors that the project could impact.

Table 3 lists the VECs that the public has identified in their comments and how they are addressed in the EA process. Additionally, there is a third column that identifies if there is a lack of regulation.

There have been various peer-reviewed studies carried out to that address many of these comments submitted by the public. Reliable source on the topics of human health, sound levels, and property values are included in the References section below sorted by topic and with a short summary of the contents.

Table 3: Valued Environmental Components identified by the public, methods of studying these in the provincial EA process, and comments on whether additional regulations are needed.

VECs Identified by the Public	How the VECs are addressed in the EA Process	Comments on Need for Additional Regulations
Waterbodies/waterways	Delineation and assessment of all wetlands, waterbodies, and watercourses that overlap with the project footprint. This includes assessment of any fish habitat. A provincial Wetland and Watercourse Alteration permit is required for any work within 30 m of a wetland or watercourse during construction. Commitments to various measures to mitigate impacts are included.	This is addressed fully through the provincial EA process.
Residential Water Supply	Studies for potential impacts to both surface water and groundwater. This includes any impact to water supply to nearby residences, including wells. Commitments to various measures to mitigate impacts are included.	This is addressed fully through the provincial EA process.
Habitat and Fragmentation - Tree clearing	Habitat assessments are carried out and impacts to the existing habitat is considered with studies extending across all areas that would be cleared for the Project. Commitments to various measures to mitigate impacts are included.	This is addressed fully through the provincial EA process.

Atmospheric pollutants - Trucking - Use of fuel and oil	Assessment of these impacts are included and put into additional context by also calculating the net greenhouse gas reduction that a project would cause. Commitments to various measures to mitigate impacts are included.	This is addressed fully through the provincial EA process.
Telecommunication Interference - Consultation	The potential for interference with telecommunication infrastructure is studied following the Radio Advisory Board of Canada guidelines called "Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems", which were updated in 2020. This includes consultation protocols with system operators. Commitments to various measures to mitigate impacts are included.	This is addressed fully through the provincial EA process.
Human Health Impacts	Studies related to noise levels, shadow flicker, electromagnetic fields, ice accumulation, fire, aviation safety, and vehicle traffic are carried out. Commitments to various measures to mitigate impacts are included.	This is addressed fully through the provincial EA process.
Recreational Use	Existing land uses are explored and consultation with the public and current land users is required. An assessment of the potential impacts to recreational use of the land is included. Commitments to various measures to mitigate impacts are included.	This is addressed fully through the provincial EA process.
Visual Environment - Impacts to viewscapes - Blinking red lights - Shadow flicker	Shadow flicker modelling is carried out. Models are required to show less than 30 hr/yr with a maximum of 30 min/day at all nearby residences under worst case conditions. A more fulsome visual assessment is also carried out. This assesses, in part, the degree to which the turbines would modify the viewscapes. Commitments to various measures to mitigate impacts are included.	This is addressed fully through the provincial EA process. It is further noted that the blinking red lights are for navigation safety and are required by Transport Canada. Additionally, Transport Canada regulates the paint colour for wind turbines.
Sound Environment - Blasting during construction - Turbine operation	Sound level modelling for project operation is carried out. Models are required to show maximum sound levels	This is addressed fully through the provincial EA process.

	less than 40 dB(A) at all nearby residences under worst case conditions. A study of construction noise is also commonly included. However, this is a shorter term impact. Commitments to various measures to mitigate impacts are included.	
Property Values **Land Use**	Proponents must demonstrate by examining the existing and planned land uses that negative impacts to current and planned land use and property values will not be a result of the project or can be mitigated. Commitments to various measures to mitigate impacts are included.	This is addressed fully through the provincial EA process.
Tourism	Proponents must demonstrate by examining the existing and planned tourism that negative impacts to tourism will not be a result of the project or can be mitigated. Commitments to various measures to mitigate impacts are included.	This is addressed fully through the provincial EA process.
Setbacks from Homes	There is no set provincial setback requirement for wind turbines from homes. However, the shadow flicker and operational sound level limits at nearby homes and investigation of property values and land uses does result in required setbacks that address the potential impacts to nearby homeowners. Ultimately, these requirements address any concerns related to the proximity of wind turbines to residences.	This is addressed fully through the provincial EA process.
Decommissioning	A plan for decommissioning activities is included. This includes plans to remove infrastructure and restore the site to its previous and/or natural state.	This is addressed fully through the provincial EA process.

Conclusion

Natural Forces believes that it is important for municipalities to have regulations specific to wind project development. At the same time, it is also important not to overlap with the regulations of other jurisdictions and to prepare regulations in alignment with industry best practice and timelines. By overlapping with the provincial process, the municipality is at risk of adding a significant resource and cost burden to their staff to review documentation which will already be reviewed by experts within provincial and federal agencies and departments.

The Municipality of Cumberland is in great position to participate in and benefit from the clean energy transition that Nova Scotia is currently going through in an effort to reach 80% renewable energy on the provincial grid by 2030. Participating in this transition brings along various benefits, which include:

- Property taxes paid to the municipal government as per the Wind Turbine Facilities Municipal Taxation Act;
- Job creation in the local area during project construction;
- Economic spinoff for local businesses during construction; and
- Reduction of greenhouse gas emissions in the province.

Natural Forces appreciates this opportunity to participate in the review of municipal regulations controlling small and large wind turbines in the Municipality of Cumberland and looks forward to further discussions and participation.

References

Topic	Reference	Summary of Findings
Human Health	Various (2014), *Wind Turbines and Health: A Critical Review of Scientific Literature* https://journals.lww.com/joem/Fulltext/2014/11000/Wind_Turbines_and_Health___A_Critical_Review_of_the.9.aspx	(1) Infrasound sound near wind turbines does not exceed audibility thresholds. (2) Epidemiological studies have shown associations between living near wind turbines and annoyance. (3) Infrasound and low-frequency sound do not present unique health risks. (4) Annoyance seems more strongly related to individual characteristics than noise from turbines
Human Health and Turbine Noise	Health Canada (2014), *Wind Turbine Noise and Health Study* https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/everyday-things-emit-radiation/wind-turbine-noise/wind-turbine-noise-health-study-summary-results.html Pamphlet: https://publications.gc.ca/collections/collection_2014/sc-hc/H129-46-2014-eng.pdf	No direct impacts of wind turbine generators themselves on human health. However, when wind turbines are sited too close to residences, some people become annoyed overtime, and they can experience stress related health concerns.
Human Health and Turbine Noise	Turku University of Applied Sciences (2021), *Health effects of wind turbine noise and road traffic noise on people living near wind turbines* https://www.sciencedirect.com/science/article/pii/S1364032121013022	The only associations with increased wind turbine noise was increased noise annoyance. No other health effects were associated. Unlike wind turbine noise, traffic noise was associated with both high levels of annoyance and self-reported health effects.
Human Health and Turbine Noise	National Institute for Public Health and the Environment and Mundonovo Sound Research (2021), *Health Effects Related to Wind Turbine Sound: An Update* https://www.rivm.nl/bibliotheek/rapporten/2020-0150.pdf	No direct relation between wind turbine sound (both audible and inaudible) and health effects. However, annoyance can be attributed to health effects, which was found to increase both with audible sound and with visual intrusion.
Property Value	University of Connecticut (2016), *Wind Turbines, Amendities and Disamenities: A Study of Home Value Impacts in Densely Populated Massachusetts* https://emp.lbl.gov/publications/wind-turbines-amenities-and	There is no statistically significant evidence that suggest wind turbines have an impact on both property value, and property sales rate.
Property Value	University of Guelph (2014), *The Effects of Wind Turbines on Property Values in Ontario: Does*	Wind turbines in Ontario (Melancthon Township) have not

DALHOUSIE UNIVERSITY

February 28, 2022

Dear Planning Department in Cumberland County,

I am a Professor of environmental and landscape social science in the School for Resource and Environmental Studies at Dalhousie, based in its Faculty of Management. I've done work on energy transitions across Canada over the last few years, among other issues of landscape change.

I recently became aware of the controversy around the planned Higgins Mountain wind farm and your County's plan for a short-term moratorium to review and possibly revise land use planning regulations around wind energy. Such regulations clearly need to keep pace with the industry, but I hope that process maintains policy settings that facilitate a wind energy transition. Nova Scotia has set some strong targets for getting off coal-fired power by 2030, and given the wind resource in Cumberland County, the region has an important role to play in meeting those targets.

I recently did some work with a Master's student, Ellen Chappell, that centred around the wind farm at Amherst, and that might provide some insight for your deliberations. I'll attach the PDFs, citations for which follow under my signature. We were interested in the landscape shift on the Tantramar from the RCI Towers to wind energy in a relatively short window, and surveyed residents of the Sackville, NB, and Amherst, NS, area back in 2018. Our survey response rate and representativeness relative to Census in the region gave us good confidence in the results (calculated at ±5.3%, 19 times out of 20).

All citizens have the right to be heard in the kinds of decisions that you face as a County, but people are not equally likely to turn out to give their opinion: negative voices may be more prominent than positive ones, but this does not mean they are more prevalent. I thought it might be useful to you to hear a little about how people feel who already have wind turbines nearby, sometimes even visible from their homes.

We found attitudes to wind were overall very supportive. Respondents supported wind in general (averaging scores of 4.3 on a scale from 1 to 5 where 3 is neutral, 4 is agree and 5 strongly agree), in the region (4.2) and in view of their homes (3.8). Support declines with proximity but not very steeply, and certainly not as steeply as you'd see in many other jurisdictions. Other researchers have also noted the support for wind energy in Nova Scotia, contrasting it with the situation in Ontario where the top-down mode of introducing renewable energy fostered more negative attitudes. The general support for wind in Nova Scotia puts us in a strong position as we approach the challenges ahead, so the political risks should not be overestimated.

I believe it is important to transition to what is often called a 'multifunctional' landscape norm, where we allow for a layering of energy into other land uses. In Canada we have not had to do much of this yet thanks to our large area, but others have. In NS we must learn how to as our population grows and electrification proceeds to reduce carbon emissions. Evidence from some national survey work I have collaborated on (also attached) suggests it is good for us to be exposed to the energy sources on which we depend. This strengthens our support for renewable modes, and may in fact inspire decisions to conserve energy, which I'll talk more about next. The truth is that energy *has* a footprint—and *deserves*

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a footprint—in our lives. Hiding that footprint only makes us less likely to understand our dependency and its costs. I would be very surprised if wind turbines had any impact on visitation at a nearby ski hill, for instance, and certainly if it had a negative one. Extrapolating from some recent research with another Master's student, Mehrnoosh Mohammadi, about integrating wind energy in vineyard contexts, if the ski hill marketed about a nearby wind farm with pride, I bet the visitor impact could in fact be positive.

In some of the media around recent wind controversies I noted quotes that indicated the speakers did not support wind energy generation particularly if it was intended for export purposes. I wanted to respond to this particularly because we also asked about this in our survey. Certainly, local generation for local use received the most support among the options we tested, especially if that was going to replace coal-fired generation (e.g. score of 4.3 on that same scale mentioned earlier). But when it came to trying to predict people's willingness to have wind energy in view of their home the two strongest predictors were agreement to the following two statements:

- Seeing wind turbines from my home reminds me that electricity I use has to be generated somewhere.
- Energy is just a commodity; if we can develop it to sell elsewhere (e.g. New England), then we should.

The second of those had a wide distribution of responses compared with the first and that centred on neutral (average of 3 compared with 3.7 on that same 1-5 scale). This indicates a wider range of opinion about the validity of export. My point in sharing this is that those who agreed to both statements have made a shift in their thinking: putting energy alongside other regional commodities as viable for export beyond local needs (as they do in more established energy-producing regions and potentially enabling a more resilient regional grid), while taking responsibility for bearing the costs of their own energy consumption too. There is a practicality in this outlook that is perhaps not surprising given the proud history of the region in terms of mineral extraction, agriculture, and more. Survey responses speak to the importance of being willing to tackle new challenges and seize new opportunities rather than hide from them by trying to hold landscapes as they are—particularly those designed for needs other than the ones we face today—or otherwise trying to exclude energy from ideas of what our landscape is 'for'. These insights might suggest some useful communication strategies as you look forward.

I close with gratitude for your service to the people of Cumberland County, if I can be of service at all, please let me know by reply email to kate.sherren@dal.ca.

Sincerely,

Kate Sherren, Professor

Chappell, E. N., Parkins, J. R., & Sherren, K. (2020). Climax thinking, place attachment, and utilitarian landscapes: Implications for wind energy development. *Landscape and Urban Planning*, *199*, 103802.

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Those who support wind development in view of their home take responsibility for their energy use and that of others: evidence from a multi-scale analysis

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Those who support wind development in view of their home take responsibility for their energy use and that of others: evidence from a multi-scale analysis

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ABSTRACT

While shifting electricity production to renewable sources is of critical importance in addressing global climate change, the costs of such development are often felt locally. This study explores what leads to support for wind development when respondents are asked to think about three different geographic scales: general, regional and within view of their home. Research was conducted in the Chignecto area of Atlantic Canada, a semi-rural area in which a prominent 15-turbine wind farm was constructed in 2012. A random population mail-out survey achieved a response rate of 40%. Questions explored exposure to wind turbines; support for wind energy development; place attachment; beliefs concerning the distribution of energy and benefits; and demographics. While most predictors of support are significant in bivariate correlations, many commonly used predictors of wind support, such as place attachment or community benefits, disappear or weaken under controls as predictors of support at smaller scales. Novel predictors of support inspired by climax thinking emerged as stronger at more local scales, including support for energy export beyond local needs and agreement that wind turbines provide a reminder of energy use. These results suggest new pathways for understanding support for wind development within the communities most directly affected.

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Community benefits; community support; energy export; local energy; renewable energy; wind turbines

Highlights

(1) Mail-out survey of residents around an existing wind farm in Atlantic Canada.
(2) Survey tests predictors of support for wind energy at national, regional, and local scales.
(3) Generally high support for wind energy found, although lowest in view of home.
(4) Place attachment, local energy use and benefits are strong predictors at general scale.
(5) Local scale support linked to support for exports and visual reminders of energy use.

Introduction

Wind energy is a renewable source with increasing presence in national grids and significant potential for further development. Shifting energy production toward renewable sources requires significant new infrastructure, and public support of such development can vary based on the perceived sites of cost and

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benefit. While many of the benefits of renewable energy accrue at large scales, costs such as visual impacts are often felt locally (Rand & Hoen, 2017). Developers and other proponents of renewable energy may still view local resistance as Not In My Back Yard (NIMBY) thinking (Wolsink & Breukers, 2010), but most scholars now agree that NIMBY fails to describe the complexity of resistance to the landscape changes associated with renewable energy infrastructure (Devine-Wright, 2005; Wolsink, 2006). While past research has focused on looking beyond NIMBY to understand opposition to renewable energy infrastructure, Batel et al. (2013) suggest moving beyond merely avoiding community opposition to projects and differentiating between acceptance and support. Acceptance implies a lack of personal agency and can involve people living with something they may not support, but do not actively oppose, while support involves a more active and positive view of a project (Batel et al., 2013). For instance, a study in Japan sought the opinions of people who had not vocally opposed a wind farm near their home and found that, while they had accepted the existing wind farm, they did not support further wind development in the region (Motosu & Maruyama, 2016).

Research on wind energy support, as well as other energy sources, has explored the role of proximity and its effects, with mixed outcomes. For instance, proximity to wind farms in Canada was shown to result in higher reported annoyance and health effects that do not always correlate with instrument-driven measurements (Barry et al., 2018). GIS-based methods are often employed to identify or split samples to compare survey data in combination with spatial energy siting information to explore drivers of support for a range of energy sources (Boudet et al., 2018; Cale & Kromer, 2015; Goldfarb et al., 2016). Clarke et al. (2016) found, for instance, that political ideology influences attitudes about unconventional fossil fuel development more as distance from such development increases. In Canada, a survey of residents within a buffer distance of existing wind turbines in Ontario asked about support for: existing wind development in the community, more in the community, more out of the community and more generally (i.e. to meet Canada's energy needs), but support was highly positively correlated across scales (Walker, Wiersma, et al., 2014). Their follow-up interviews revealed most concerns seemed 'multi-scalar' (p. 734), not surprising given the highly politicized context for wind in that jurisdiction (Sherren et al., 2019). Splitting samples based on stated impacts is more rare, as done by Krause et al. (2016) to distinguish those who can hear or see turbines from home from those who could not. Comparing the support of these two groups for wind development across five scales, Krause et al. (2016) found that while support wanes at the most local scales (within sight and on their property), those currently affected are more supportive overall and predictors of support vary at the extremes (country vs. property). The varying results on proximity and exposure variables are likely driven by variation at the scale of case or region: culture and demographics, vernacular landscapes arising from local livelihoods, local experiences with energy development in the past, and material and cognitive energy cultures (Stephenson et al., 2010).

Many of the existing studies of proximity and energy support, including many of those mentioned above, build on socio-psychological construal-level theory and psychological distance. Construal level theory explains that we use more theoretical ways to conceptualize and assess an issue when we do not have concrete experience with it, for instance with increasing geographical or social distance (Trope & Liberman, 2010). As such distances increase, for instance, more abstract things like political ideology or other cognitive shortcuts will be employed, as Clarke et al. (2016) and Tan et al. (2020) found in studying support for unconventional oil and gas. A new concept called climax thinking (Sherren, 2021) is consistent with construal level theory in how it uses distance (physical, social or temporal) to explain willingness to accept public good landscape change. Climax thinking builds on succession theory to propose that many individuals view their surroundings as at an optimal endpoint reached after years of human progress: an 'equilibrium' that deserves to be sustained (Chappell et al., 2020; Sherren, 2021). Within the climax thinking framework exceptionalism or ignorance are hypothesized to be mobilized across time and space to resist public good landscape change such as wind development. Such hypothetical relationships in turn inspire ideas about how to reduce climax thinking, including exposing people to the means by which their electricity is generated and facilitating a 'local energy' ethos akin to 'local food' that takes responsibility for and pride in local production (Sherren, 2021). A first measurement of climax thinking was recently correlated with support for wind energy development only for those who can currently see turbines from home, in other words, those for whom the turbines are part of their *status quo* landscape (Chappell et al., 2020). This perspective suggests that climax thinking involves support for wind

where it already exists, a phenomenon consistent with other research that indicates comfort grows with familiarity (Hallan & González, 2020; Sherren et al., 2019). It may also indicate that climax thinking is particularly powerful for understanding and influencing responses to landscape change at very local scales.

In this study, we use a mail-out survey to explore factors associated with support for wind energy development among people living around a 15-turbine wind farm in the Chignecto area of Atlantic Canada. Specifically, we focus on understanding how the distribution of energy and related project benefits compare with other factors in influencing support for wind development in general, and a regional and local scales. In doing so we explore some of the common variables discussed above such as local energy use and benefits, but add novel variables related to climax thinking: willingness to engage in energy export and to be reminded of energy use through hosting infrastructure. Here we test these and other predictors of wind energy support at different scales to inform more widespread wind energy transitions. What kind of thinking about wind energy facilitates local development, compared with support for development further away?

Background

Several possible explanations of community support for renewable energy development relate to the distribution of energy and benefits from the development, including local use versus export of energy, community ownership, community benefits and job creation. Alternative explanations to these distribution factors include place attachment, proximity to infrastructure, politics and demographics. This section provides background on each, indicating what we expect to find in our study based on past research. While we focus primarily on wind energy support in this study, many of the factors discussed below do not exclusively relate to support and may also influence opposition, depending on the individual, the community or the context; we did not differentiate support from opposition in our scale building.

Local use

Some research suggests that residents in a host community may be more accepting of a renewable energy development if the energy generated is used locally rather than exported, and this is what we expect to find here. As stated by Rand and Hoen (2017), North American wind energy survey respondents consistently express concern that the energy produced from local wind farms is consumed elsewhere. Additionally, local use of renewable energy may be valued if it replaces fossil fuel generation in the region; Firestone and Kirk (2019) found that 90% of individuals living within 8 km of a wind turbine in the U.S. would prefer the wind development over a fossil fuel plant located the same distance away. Local use of renewable energy can also help address energy security concerns by replacing imported fuel or electricity (Kaldellis et al., 2013), providing greater control to communities, and instilling an idea of 'energy citizenship' in the community (Hufen & Koppenjan, 2015; Musall & Kuik, 2011).

Communities taking ownership of their energy by locally generating the energy they consume may contribute to increased support for renewable energy, if they are perceived as having lower environmental and health risks than conventional, and decreased electricity consumption. As noted by Adams and Bell (2015), the centralised energy systems typical of fossil fuel generation result in spatial and psychological distance between electricity generation and consumption, as fuels are often both extracted and combusted in remote locations. The emerging theory of climax thinking suggests in part that people can have difficulty imagining the impacts of their energy choices on landscapes and people elsewhere (Sherren, 2021). By contrast, the presence of renewable energy infrastructure near communities can provide visual reminders that energy must be generated somewhere, helping to raise consciousness about the consequences of electricity use (Nadai & van der Horst, 2010). A recent Canada-wide study of support for various types of energy sources found that indicating on the survey that they notice any type of energy infrastructure was a significant predictor of increased support for renewable sources (Sherren et al., 2019). We hypothesise that support for wind energy from residents living in the vicinity of an exisiting wind farm is positively associated with a desire for the energy produced to be used locally.

Energy exports

Related to the above, we expect to find that wind development for energy export would have a negative impact on support. Energy exports tend to be a sensitive topic for those bearing the cost of energy production, but it comes with the potential for significant benefits flowing to owners and consumers within the energy system. Gullberg et al. (2014) suggest that exporting renewable energy that is excess to local needs can help balance across jurisdictions the intermittency issues associated with renewables, making a stronger overall system. This is distinct from development designed for export that does not serve local areas, such as in hydroelectricity development in Labrador, Canada (Mercer et al., 2020). For example, the development and transmission of pumped-storage hydro in Norway could balance the intermittency associated with wind energy in Germany (Gullberg et al., 2014). Similarly, wind development in the Irish Midlands for export to the UK could benefit both countries through improved system efficiency, lower electricity prices and increased energy security (Brennan et al., 2017). Interconnected grids can also help jurisdictions achieve renewable energy targets by importing from regions that have already met their targets and have surplus (Gullberg et al., 2014).

Despite the potential benefits of renewable energy developed for export, it can also raise concerns for host communities, though there is limited research on this topic (Brennan et al., 2017). Locals may question whether they will experience economic benefits from development, given they may in fact experience costs, such as temporary increases in electricity prices until the energy producer has paid off debts from the development (Brennan et al., 2017; Gullberg et al., 2014). In a survey around locations in the Irish Midlands where large-scale wind developments are proposed for export to the UK, 59% of respondents were opposed to wind development for export, compared to 43% for domestic use (Brennan et al., 2017). In focus groups, local residents shared concerns that they would shoulder the costs of the wind farm, while the development would benefit wind farm operators, private corporations, and the UK market. While renewable energy production for export has potential benefits, it can further entrench the unequal distribution of costs and benefits associated with energy production. We expect that people living around a wind farm who report high support for wind energy report low support for the energy being exported to other jurisdictions.

Local benefits

Most research would lead us to expect that direct benefits to the local community would be a positive predictor of wind energy support, particularly at local scales. Irrespective of whether the electricity generated is used locally or exported, host communities can profit through either local ownership of developments or through compensations or additional benefits provided by the developer (Rudolph et al., 2017). Some studies have found community ownership of developments can increase public support for renewable energy, among other benefits. In a questionnaire-based German study, residents in the town around a community co-owned wind farm were consistently more positive than residents around a privately owned wind farm (Musall & Kuik, 2011). In Belgium, members of an energy cooperative similarly had more favourable attitudes about wind energy than non-members, the latter of whom tended to be ambivalent rather than opposed (Bauwens & Devine-Wright, 2018). The real scale and source of community benefits over time need to be carefully studied, however, according to ambiguity in outcomes identified in Scotland (Slee, 2015).

When renewable energy is developed by a private corporation rather than through community ownership, benefits may be paid to the community by the developer. An experimental study of the impact of community benefits on support for a hypothetical offshore wind development in England found that focusing on collective rather than individual benefits may have the greatest impact on support, although this can also be controversial as community benefits can sometimes seen as bribes (Walker, Wiersma, et al., 2014). In Ireland, 76% of local focus group participants believed reduced or free electricity to be the best compensation for wind farm developments (Brennan et al., 2017), and it was also advocated to strengthen support for wind in a high-installation region of the US midwest (Mulvaney et al., 2013); some renewable energy developers have begun providing this individual benefit (Walker, Baxter, et al., 2014). We hypothesise that support for wind energy from

those living around an exisiting wind farm will be positively associated with a desire for the community to own or profit from the wind development.

Jobs and leases

Expectations of benefits at the individual rather than community scale would also be likely to increase support for wind development based on existing research. Nearby residents can profit through the creation of jobs and direct economic benefits associated with a renewable energy development. As most wind farms are constructed in rural regions, which often have limited or declining industries, such developments can help increase economic activity (Slattery et al., 2011). In a study of wind farm support in Australia, interview participants discussed the importance of direct financial benefits of wind farms including rental income to turbine hosts (Hall et al., 2013). In Northern Sweden, Ejdemo and Söderholm (2015) found that employment benefits are marginal in the absence of benefit-sharing mechanisms, but still important.

In addition to lease payments, local employment is often cited by proponents of wind energy as a key benefit of developments (Brennan et al., 2017). Local economic development from a renewable energy project can occur through the creation of both direct and indirect jobs (i.e. workforce expenditures), although the scale is dependent on multiple factors (Dalton & Lewis, 2011; Slattery et al., 2011). Jobs can also vary over time: participants in the study by Hall et al. (2013) noted that job opportunities were most common during the construction phase of a wind development but decreased significantly during the long-term operation. Local ownership or community empowerment around wind development tend to result in more local job creation (Slattery et al., 2011).

While increasing the amount of energy obtained from renewable sources is likely to increase jobs in these sectors, it may also decrease jobs in the fossil fuel sector (Longo et al., 2008). However, in their comparison of job creation across different energy sources, Dalton and Lewis (2011) note that jobs/MW of onshore wind energy in Europe is higher than job creation from conventional thermal energy sources. We hypothesise that support for wind energy from residents living in the vicinity of a wind farm is negatively associated with a belief that wind energy provides fewer jobs than other forms of energy generation.

Other factors influencing support

In addition to the factors discussed above, several other variables including place attachment, exposure to infrastructure and political views have been found to influence support for renewable energy developments from surrounding communities. Place attachment is likely to reduce support for local wind development, based on the literature to date. Devine-Wright (2009) proposed place attachment as an alternative to NIMBY-ism, suggesting that local opposition to renewable energy infrastructure often results from place-protective attitudes, as new developments can threaten local people's emotional attachment to their home and surrounding landscape. In a comparison study of two towns located an equal distance from an off-shore wind development in Wales, Devine-Wright and Howes (2010) found support for the development to be higher in the town that was viewed less favourably by its inhabitants, suggesting support is inversely related to place attachment. Perceptions of how the specific technology fits in the landscape or seascape has also been found to be important (McLachlan, 2009). We expect that those with high place attachment to our study region will report lower support for wind development in the area.

The impact of proximity and exposure to renewable energy infrastructure has also been explored in past studies, although with highly varying results. In their review of North American wind energy research, Rand and Hoen (2017) report that some studies have found residents who see turbines more frequently are less likely to have positive attitudes towards the development, but that overall both the direction and strength of the correlation between proximity and support is mixed. A study in Ontario by Baxter et al. (2013) found that 69% of people in a community with an existing wind farm development would vote in favour of local turbines, compared to only 25% of people in a community without a development. Krause et al. (2016) found similarly in Washington and California that those who said they could see or hear wind turbines

were more likely to support wind development across all scales than those who did not. We do not anticipate proximity to wind turbines to have a significant impact on support for wind energy from residents living in the vicinity of a wind farm.

The impact of political views on support for renewable energy has also been explored in past studies, again with varying results. A study in Norway by Karlstrøm and Ryghaug (2014) found political party preference to be a significant predictor of attitudes towards renewable energy technology. However, a recent study in the US by Firestone and Kirk (2019) found no statistical difference in support for wind energy between Republican and Democratic states. In a Canadian study exploring the politics of wind energy in Ontario compared to Nova Scotia (NS), Walker et al. (2018) found support in Ontario to be significantly more politicised compared to support in NS, where support was generally high regardless of political preference. Beliefs concerning wind energy may be impacted by political views as energy issues are often connected to other values and beliefs that have become politicised, including environmental, economic and justice considerations (Stirling, 2014). Additionally, rhetoric from political party leaders as well as from advocacy groups is often polarized, further impacting public beliefs around energy issues (Carmichael & Brulle, 2017). Together, the political issues that underlie energy decisions as well as the polarized rhetoric from political elites can contribute to political views being used as cognitive shortcuts, particularly in the absence of direct experience with energy developments (Sherren et al., 2019), as Clarke et al. (2016) found political ideology to be an increasingly strong predictor of support for hydraulic fracturing in the US as distance from a development increased. As wind energy has not been highly politicised in our study region, we do not expect support for wind energy to be significantly associated with politics.

Finally, demographic variables have frequently been shown not to be significant predictors of renewable energy support. In their review of North American research, Rand and Hoen (2017) report that gender, income and education level usually do not explain variations in support for wind energy. However, women have consistently been found to demonstrate higher pro-environmental attitudes than men (Xiao & McCright, 2015), and a study by Sherren et al. (2017) concerning a potential dam removal in Atlantic Canada found opinion and rationale differences between men and women. We do not expect to observe a significant association between demographic variables and support for wind energy.

Methods

Study area

For this study, we focus on a wind development in Atlantic Canada located in the rural Chignecto area on the narrow (24 km) isthmus border between Nova Scotia (NS) and the neighbouring province New Brunswick (NB). The Chignecto area is a low-lying and windy region located near the Bay of Fundy, an inlet of the Gulf of Maine. The area includes the towns of Sackville, NB (population 5,331), and Amherst, NS (population 9,413). Single case research of this kind allows for a richly contextualized story to emerge (Flyvbjerg, 2006; Ruddin, 2006), to target falsification and better ground insights in real places. However, we recommend that additional research be conducted in other settings, both with similar and different wind energy dynamics, to test the robustness of the findings we observe here.

This is a valuable case because of its long history of settlement (by North American standards), and its history of landscape modification for utilitarian purposes: agricultural, iron ore, and telecommunications (Chappell et al., 2020; Sherren et al., 2016). Energy is a more recent addition. A 15-turbine, 31.5 MW commercial wind farm with no community ownership was constructed by Sprott Power in the region in 2012, with the energy sold to the privately owned NS Power utility to power homes in the area (Maritime wind, 2012). The wind farm is situated approximately three kilometres west from the Amherst town centre and approximately ten kilometres southeast from the Sackville town centre and is visible across much of the area due to the flat topography. An additional three turbines have been constructed in the area since 2012, with all 18 turbines existing prior to the distribution of the survey (Cole, 2019). Community consultation meetings do not appear

to have occurred for the 15-turbine wind farm, but public comments were accepted from May 1, 2008 to May 15, 2008 when the project had a different proponent (Government of Nova Scotia, 2017).

The Chignecto region is embedded in an Atlantic region with high wind resources relative to the rest of Canada, and increasing wind energy installations thanks in part to policy incentives in support of renewable energy targets (Koto & Yiridoe, 2019). Unlike in Ontario, where wind energy was imposed in a top-down way, in Nova Scotia a community feed-in-tarrif guaranteed set energy prices for renewable infrastructure projects that had significant community investment (Adams et al., 2011; Walker & Baxter, 2017). Support for wind development is on average lower in Ontario than any other region, including Alberta, which is highly invested in conventional oil and gas (Sherren et al., 2019). Carbon pricing plans in Canada mean that governments are targeting more installed wind capacity in many regions; according to the industry it was already at 5 percent of electricity generation in 2018 with 6771 turbines across 301 wind farms as of December 2019 (CanWEA, 2019; Government of Canada, 2020).

Survey design and implementation

We designed a survey to measure support for wind energy in general, at regional scales and in view of home, and distributed it to randomly selected homes in the Chignecto area (the questionnaires are available online here: http://katesherren.org/energy-landscape-exposure-2015/). We do not use exact distances to demarcate these three scales, instead defining them conceptually. We define the local or home view scale to mean turbines that can be seen from an individual's home. The regional scale referred to the Chignecto area, but not necessarily in view of home. For the purposes of survey distribution we defined the Chignecto area using two postal Forward Sortation Areas (FSAs) of B4H and E4L that cover 40 km of the isthmus. While we provided a map on the survey to delineate our definition of the Chignecto area, residents may have had their own area in mind when responding to wind energy and place attachment questions about the Chignecto region. The general scale refers to beliefs about wind energy broadly as well as wind energy developed in Canada but outside of the Chignecto area.

All surveys included question sets asking about exposure to wind turbines; support for current and future wind energy development at the three scales above; place attachment to the Chignecto region; beliefs concerning the distribution of energy and benefits from wind farms; and demographics. Half the surveys also contained an experimental section about past landscape change in the Chignecto area. The results of the experimental treatment are discussed elsewhere and not used here (Chappell et al., 2020). Briefly, we presented four images of technologically superseded landscape features in the region (agricultural dykes, foundry stacks, microwave radio towers, large hay barns) and asked for respondents' familiarity with them, assessments of landscape fit and feelings about their loss. Exposure to the images was meant to frame wind as only the most recent in a line of utilitarian landscape features, but – perhaps because the attitudes toward wind in the region were so positive overall – the experimental treatment had no significant impact(Supplemental Table 1).

The survey was administered via postal mail from May until July 2018, targeting residents of two FSAs through property databases publicly available in the area. An initial postcard was mailed to 1000 randomly sampled residents followed by the first copy of the survey, a reminder postcard, a second identical copy of the survey, and a final reminder postcard, each mailed one to two weeks apart. Responses were incentivized by entry into draws for Visa gift cards, with the first 100 respondents being entered to win one of five $50 gift cards and all subsequent respondents being entered to win one of five $20 gift cards.

Over the two-month mail-out survey period, a total of 335 surveys were completed out of the 843 that were deliverable for a response rate of 40%. The completed surveys represent a total population of 16,311 people over the age of 19 in the study area, giving a confidence interval of ±5.3 at the 95% confidence level. Comparing demographics of the survey respondents to census data for each of the two FSAs, the survey population represents the overall population relatively closely (Table 1), with some notable differences (Statistics Canada, 2017). We do not use weighting to remove these differences, but recommend that caution should be taken with extrapolating results of this study to younger and less educated residents of the region as well as males in NB and lower income residents in NS, as these groups were underrepresented in our survey results.

Table 1. Demographics of survey respondents and model controls compared to census data for postal code forward sortation areas E4L and B4H, using percent (Statistics Canada, 2017).

Census	E4L (Sackville)	B4H (Amherst)	Survey	Sackville (n = 148)	Amherst (n = 187)
Gender					
Female	52.1	53.0	Female	58.5	52.5
Male	47.9	47.0	Male	41.5	47.5
Age					
20–24	6.8	5.7	19–24	2.1	1.1
25–34	11.1	11.6	25–34	8.5	1.7
35–44	14.1	14.4	35–44	12.0	10.1
45–54	17.7	17.9	45–54	14.8	18.4
55–64	20.1	20.5	55–64	28.2	26.3
65–74	15.2	16.1	65–74	17.6	29.6
75+	15.1	13.8	75+	16.9	12.8
Income (CAD)					
Under 25,000	13.3	21.1	Less than 26,000	12.6	13.1
25,000–49,999	18.9	28.1	26,000–50,999	21.0	27.6
50,000–79,999	22.0	23.6	51,000 to 75,999	21.8	24.1
80,000–100,000	10.5	9.8	76,000 to 99,999	12.6	14.5
100,000+	22.0	17.4	100,000 or more	21.8	20.7
Education					
High school or less than HS	38	46	High school or less than HS	28	26
College or trade apprenticeship	33	39	College or trade apprenticeship	28	41
University undergraduate or graduate	29	15	University undergraduate or graduate	44	33

Data and analyses

The statistical software STATA was used to analyse responses from completed surveys, once they were received and manually input to a Microsoft Excel spreadsheet.

Dependent variables

Three question sets were designed to measure support for wind energy development at the general, regional, and home view scales as previous research has found that levels of support and the factors influencing support vary depending on proximity to a development (Rand & Hoen, 2017). Questions were asked on five-point Likert scales in both positive and negative directions. Exploratory factor analysis using oblimin oblique rotation was conducted for each of the three question sets to create scales (Supplemental Tables 2–5). The local scale had all six statements loaded most strongly on the first factor, which was also the only factor with an eigenvalue greater than one for this scale. The general scale showed the first five statements to load most strongly on the first factor, again the only factor with an eigenvalue greater than one, and the last statement ((f). Wind energy provides fewer jobs than other energy sources) to load more strongly on the second factor. We removed this statement from the general scale and instead used it to create a predictor variable, as we had not asked about job creation in other predictor variables. The regional factor analysis was more complex, with two scales emerging aligned with the positive and negative statements respectively. After the removal of one double-barreled positively phrased statement (b), we had concern about excluding the other (a), leaving four negatively phrased questions to comprise a regional 'support' scale; the Cronbach's alpha supported us keeping all five statements. Negatively-phrased questions were reversed and means were used to combine responses into three scales measuring support for wind energy from one to five at each of three levels.

Predictor variables

Key predictor variables are derived from questions about distributional justice, energy use, ownership and benefits. Several questions were combined into scales based on conceptual similarities and reliability tests, while others were kept as individual questions to create a total of five key predictor variables.

Additional predictor variables in this study include exposure to turbines, place attachment and politics. A question asking respondents if they see or hear turbines from their home (yes or no; coded as yes = 1, no = 0 for regression) was used to measure exposure to turbines. Five statements were used to measure place attachment to the Chignecto region, adapted from a study by Raymond et al. (2010). These statements were averaged to create a scale from one (low place attachment) to five (high).

To measure political views, respondents were given four options, reflecting political parties in the region; Conservative, Liberal, New Democratic Party and Green, as well as an option for other. This question had the lowest response rate, with 198 respondents selecting a political party, 107 people choosing not to answer, and 30 people selecting 'other'. The question was recoded to be a dichotomous variable with 'Conservative' (coded as 1) and 'Not Conservative' (coded as 0), and 'other' treated as missing data. The Conservative party is the only major party in Canada classified as right-wing, while the other three are considered centrist or left-wing (Sherren et al., 2019).

Control variables

Province, years lived in the region, gender, age, education and household income were used as control variables (Table 1). As well as acting as controls, demographic data also allowed comparison to the overall population of this region from the Census of Canada (Statistics Canada, 2017). Province was recorded based on the postal code of respondents. Years lived in the Chignecto region was asked as a written response question. Gender was asked with options provided for female, male and non-binary. Age was asked in categories, from 19-24, and then in ten-year categories up to 75+. Education was recoded into three categories; 'high school or less than high school', 'college or trade apprenticeship' and 'university undergraduate or graduate' from eight options originally provided on the survey. Income was also asked in ~$25,000 categories, from 'less than $26,000' to '$100,000 or more'.

Results

Dependent variables

Support for wind energy development at the general, regional and home view scales is found to be generally high, and declining across the three geographic scales (Table 2). GENERAL has a mean of 4.3 on the five-point scale (alpha = 0.81), followed by REGIONAL with 4.2 (alpha = 0.91) and HOME VIEW with 3.8 (alpha = 0.88).

Predictor variables

Our results suggest that local communities have an interest in the distribution of energy and benefits generated by nearby wind development (Table 3). Of the five key predictor variables, the *local energy use* scale has the highest mean at 4.3 (alpha = 0.76), showing that support for wind energy is linked to its supply of local power. The *local benefits* scale, measuring whether respondents' support for wind energy is linked to local ownership or profits to be shared with the municipality, has a mean of 3.9 (alpha = 0.79). Interestingly, while respondents agree with the local use of energy from the wind farm, some are also supportive of energy being exported, including internationally to New England (northeastern United States). Respondents are almost exactly split regarding *energy as a commodity*, with a mean of 3.0. Responses are again divided over whether there are *fewer jobs from wind*, with a mean of 3.0 and 58% selecting neutral. Finally, the *reminder of energy use* statement earns a mean of 3.7 with 64% of respondents agreeing or strongly agreeing.

Examining the alternative predictor variables (Table 4), 40% of respondents report seeing wind turbines from their home, while 60% do not. Respondents overall report high place attachment to the Chignecto area, with a mean of 4 out of 5 on the *place attachment* scale (alpha = 0.88), not surprising since the average time respondents lived in the area was 40.7 years (SD = 21.9). Finally, for political views, 37% of those who responded identify as *conservative* while 63% are *not conservative*.

Table 2. Questions, response options and descriptive statistics for support for wind energy development at three different scales.

Dependent variables	Descriptive statistics					
	1	2	3	4	5	Mean
Likert scale response options from 1 (strongly disagree) to 5 (strongly agree)	Distribution (%)					(S.D.)
GENERAL wind support $n = 331$						
Wind energy is a cleaner alternative to fossil fuel energy.	0	1	6	29	64	4.56 (0.66)
Canada is already overbuilt with wind farms.[a]	0	1	13	45	40	4.23 (0.75)
Wind energy is an economic opportunity.	1	3	12	42	40	4.17 (0.88)
Wind energy development is unnecessary because we have enough other sources of energy in Canada.[a]	1	2	6	47	43	4.29 (0.78)
Wind energy should be further developed in Canada for environmental reasons.	2	2	10	43	43	4.22 (0.88)
General wind support Cronbach's alpha	0.81					4.29 (0.61)
REGIONAL wind support $n = 330$						
I would be happy to see more wind energy development in the Chignecto area.	2	14	17	38	39	4.09 (0.93)
I would like to see no wind turbines in the Chignecto area.[a]	2	2	9	36	51	4.31 (0.89)
Wind turbines do not fit well in the landscape of the Chignecto area.[a]	2	3	16	39	39	4.09 (0.95)
I would like any current wind turbines in the Chignecto area to be removed rather than replaced after they reach their 25-year life span.[a]	2	3	9	39	47	4.27 (0.87)
I believe wind turbines are a negative addition to the Chignecto landscape.[a]	2	3	12	38	45	4.20 (0.93)
Regional wind support Cronbach's alpha	0.91					4.19 (0.79)
HOME VIEW wind support $n = 330$						
I would prefer not to see wind turbines from my home. [a]	6	12	26	38	18	3.51 (1.09)
I think wind turbines can be beautiful and wouldn't mind having a view of them from my home.	4	11	22	47	17	3.63 (1.00)
Wind turbines can be a useful landmark and tell me I am getting close to home.	4	6	25	47	17	3.67 (0.96)
I would not mind seeing wind turbines from my home if they are contributing to clean energy and a more sustainable future.	3	5	9	53	30	4.04 (0.90)
I think that wind turbines near my home would have a negative impact on my health. [a]	3	6	24	40	27	3.83 (0.99)
Seeing wind turbines from my home would ruin my view. [a]	3	7	16	46	27	3.87 (1.00)
Home view wind wupport Cronbach's alpha	0.88					3.76 (0.79)

[a]Reversed.

Regression

Although all five key predictor variables are strongly significant in the correlations (Table 5), several of these variables lose significance in OLS regression (Table 6). However, other than for the *fewer jobs from wind* variable, which stays as a relatively strong negative predictor in all three models under controls, there seems to be a

Table 3. Questions, response options and descriptive statistics for key predictor variable questions and scales.

Key predictor variables	Descriptive statistics					
	1	2	3	4	5	Mean
Likert scale response options from 1 (strongly disagree) to 5 (strongly agree)	Distribution (%)					(S.D.)
Local energy use scale: $n = 333$						
I would more strongly support wind farm development in the Chignecto area if the energy generated is used locally.	1	3	12	39	45	4.22 (0.87)
I would more strongly support wind farm development in the Chignecto area if the energy generated is used to replace coal or other fossil fuel energy generation within the region.	1	2	10	39	48	4.30 (0.83)
I like the idea of generating the energy I use locally.	0	1	8	49	42	4.32 (0.68)
Local Energy Use scale Cronbach's alpha	0.76					4.28 (0.65)
Local benefits scale: $n = 330$						
I would more strongly support wind farms in the Chignecto area if they were owned locally through cooperatives or municipal corporations.	1	6	29	42	22	3.78 (0.90)
I would more strongly support wind farms in the Chignecto area if profits were distributed to local municipalities.	2	2	18	46	33	4.06 (0.86)
Local benefits scale Cronbach's alpha	0.79					3.92 (0.80)
Energy as a commodity: $n = 328$						
Energy is just a commodity; if we can develop it to sell elsewhere (e.g. New England), then we should.	8	26	30	26	9	3.03 (1.11)
Fewer jobs from wind: $n = 324$						
Wind energy provides fewer jobs than other energy sources.	7	13	58	18	3	2.96 (0.86)
Reminder of energy use: $n = 326$						
Seeing wind turbines from my home reminds me that electricity I use has to be generated somewhere.	3	8	25	48	16	3.67 (0.93)

Table 4. Questions, response options, and descriptive statistics for alternative predictor variables. $n = 335$.

Independent variables	Distribution (%)					Mean (S.D.)
Seeing turbines						
Ever seen			314 (97%)			
Drive past weekly			301 (92%)			
See from where I work/study			97 (31%)			
See from home			133 (40%)			
Place attachment: Likert scale response options from 1 (strongly disagree) to 5 (strongly agree)	1	2	3	4	5	
The Chignecto area means a lot to me.	0	1	13	38	48	4.32 (0.75)
I live in the Chignecto area but do not feel attached to it.[a]	35	39	14	10	2	2.05 (1.04)
I feel the Chignecto area is a part of me.	1	8	24	39	28	3.84 (0.96)
I identify strongly with the Chignecto area.	1	9	24	38	28	3.82 (0.98)
I would prefer not to live in the Chignecto area.[a]	45	39	11	4	1	1.76 (0.85)
Place attachment scale Cronbach's alpha	0.88					3.99 (0.84)
Political views: What party best represents your political views, whether or not you vote?	1	2	3	4	–	–
Response options: Green (1), NDP (2), Liberal (3), Conservative (4).[b]	11	16	40	37	–	–

[a]Negatively phrased, reversed for scale.
[b]Percentages add up to greater than 100 as some respondents selected multiple responses (e.g. Liberal and Conservative).

spatial pattern in which predictors are operating where. For the GENERAL scale, the strongest predictors are *local energy* and *fewer jobs from wind* ($p < 0.001$); the other three have positive associations but they are weaker: *local benefits* and *reminder of energy use* ($p < 0.01$) and *energy as a commodity* ($p < 0.05$). By contrast, for HOME VIEW, *reminder of energy use* and *energy as a commodity* have the strongest associations ($p < 0.001$); *local energy* and *fewer jobs from wind* are a little weaker ($p < 0.01$) and *local benefits* has lost significance entirely. The REGIONAL model is a mix of the two, closer to GENERAL on *local energy* ($p < 0.001$) and *reminder of energy use* ($p < 0.05$), and matching HOME VIEW on *energy as a commodity* ($p < 0.001$), fewer jobs from wind ($p < 0.01$), and *local benefit* (not significant).

To maintain a strong n in the final regression analysis we removed both the political variable and the income variable, due to a low response rate for both questions, but in earlier models run including these variables no significance was found for either variable under controls. Many of the other alternative predictor

Table 5. Bivariate correlations for predictor and control variables for each of three Wind Support scales.

Variable	General	Regional	Home view
Distribution predictors			
Local energy use scale $n = 333$	0.46 (0.00)***	0.34 (0.00)***	0.27 (0.00)***
Local benefits scale $n = 330$	0.32 (0.00)***	0.18 (0.00)***	0.18 (0.00)***
Energy as a commodity $n = 328$	0.19 (0.00)***	0.26 (0.00)***	0.21 (0.00)***
Fewer jobs from wind $n = 324$	−0.32 (0.00)***	−0.24 (0.00)***	−0.23 (0.00)***
Reminder of energy use $n = 326$	0.34 (0.00)***	0.29 (0.00)***	0.34 (0.00)***
Alternative predictors			
See turbines from home $n = 329$	−0.01 (0.89)	−0.07 (0.20)	0.09 (0.12)
Place attachment $n = 334$	0.25 (0.00)***	0.17 (0.00)***	0.13 (0.02)*
Conservative $n = 197$	−0.22 (0.00)***	−0.20 (0.00)***	−0.03 (0.67)
Controls			
Nova Scotia $n = 334$	−0.05 (0.33)	−0.03 (0.64)	0.07 (0.19)
Years in region $n = 317$	−0.07 (0.20)	−0.08 (0.17)	0.01 (0.90)
Male $n = 320$	−0.00 (0.95)	−0.01 (0.86)	−0.04 (0.52)
Age $n = 320$	−0.05 (0.40)	−0.05 (0.38)	−0.01 (0.80)
HS/ less than HS $n = 319$	−0.18 (0.00)***	−0.10 (0.09)	−0.03 (0.60)
College/ trade $n = 319$	0.09 (0.11)	0.01 (0.92)	0.08 (0.16)
University $n = 319$	0.08 (0.15)	0.08 (0.15)	−0.05 (0.37)
Income $n = 263$	0.10 (0.12)	0.09 (0.16)	−0.03 (0.64)

*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.
All correlations are Spearman correlations for consistency and ease of reporting as many of the variables are categorical rather than continuous.

Table 6. Mulitvariate (OLS) regression for predictor and control variables for each of three wind support scales (standardised coefficients).

Variable	General $n = 291$	Regional $n = 291$	Home view $n = 290$
Key predictors			
Local energy use scale	0.29 (0.00)***	0.32 (0.00)***	0.18 (0.01)**
Local benefits scale	0.15 (0.01)**	0.06 (0.31)	0.07 (0.24)
Energy as a commodity	0.11 (0.02)*	0.21 (0.00)***	0.20 (0.00)***
Fewer jobs from wind	−0.27 (0.00)***	−0.17 (0.00)**	−0.16 (0.00)**
Reminder of energy use	0.14 (0.01)**	0.13 (0.01)*	0.25 (0.00)***
Alternative predictors			
See turbines from home	−0.02 (0.64)	−0.09 (0.08)	0.01 (0.93)
Place attachment	0.17 (0.00)***	0.10 (0.07)	0.06 (0.27)
Controls			
Nova Scotia	−0.08 (0.11)	−0.01 (0.81)	0.05 (0.41)
Years in region	−0.12 (0.04)*	−0.08 (0.23)	−0.05 (0.45)
Male	0.06 (0.18)	0.02 (0.71)	−0.04 (0.48)
Age	0.06 (0.32)	−0.01 (0.82)	−0.02 (0.71)
College/trade[a]	0.17 (0.01)**	−0.04 (0.58)	−0.02 (0.75)
University[a]	0.18 (0.00)**	0.03 (0.71)	−0.11 (0.12)
Constant	2.20 (0.00)	1.73 (0.00)	1.74 (0.00)
Adjusted R^2	0.40	0.28	0.27

[a]Dichotomous with high school/ less than high school as reference.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

variables also lose significance in regression, with only one significant association remaining: between *place attachment* and GENERAL support (Table 6) ($p < 0.01$). Finally, for the control variables, the association between education and GENERAL support persists, with a negative bivariate correlation of high school or lower education replaced by positive influence of both college ($p < 0.01$) and university ($p < 0.001$) education (Table 6). *Years in the region*, which was not significant in bivariate correlations emerges as weakly negative at the GENERAL scale under controls ($p < 0.05$). None of the alternative predictor or control variables are significant for support at either the REGIONAL or HOME VIEW scales. The REGIONAL scale has the highest adjusted *R*-squared value (0.40), followed by GENERAL and HOME VIEW, much lower at 0.28 and 0.27, respectively.

Discussion

We observe overall high support for current and future wind energy development from survey respondents. The mean support of 3.8 at the local scale is comparable to the mean support of 3.71 out of 5 found by Hoen et al. (2019) in their nationally representative survey of residents living within 8 km of wind turbines in the US, a similar proximity to that of our study area. However, our study observed some unexpected patterns in drivers of support across scales. Following Krause et al. (2016), who elicited support for wind at five scales in Washington and California, but only modelled support at the two most extreme ones (country vs. property scale) we focus here on support in general and in view of home; the Chignecto regional model was a mix of these.

Common predictors fail

Several variables that have previously been linked to support for wind energy have weak predictive power in this study, particularly in predicting support for development in view of home. Seeing turbines from home and support for wind energy were not correlated at any scale in our study, as some others have found (Baxter et al., 2013; Rand & Hoen, 2017). Additionally, in their study in the UK, Jones and Eiser (2009) found there to be a strong correlation between general attitudes towards wind energy and support for local development, while in our study, there is only a moderate correlation between support in general and in view of home (rho = 0.52).

Political views were significant in general and at the regional scales in bivariate correlations, consistent with previous studies that have found it to be a significant predictor of support for renewable energy (Karlstrøm & Ryghaug, 2014). Because of missing variables, however, we dropped political views from the regression to maintain sample size. This decision was also made because alternative models that did include political views showed this variable to be insignificant. Community ownership, the distribution of profits to the host community, and local job creation have similarly been shown elsewhere to influence support at the local scale (Hall et al., 2013; Musall & Kuik, 2011; Slattery et al., 2011; Walker, Baxter, et al., 2014). Although the *local benefits* variable and *fewer jobs from wind* variable are strongly significant at all scales in bivariate correlations, they lose significance in the regional and home view regression models: *fewer jobs* remains significant but the magnitude of the effect diminishes whereas *local benefits* disappears entirely. A possible explanation for this result in our study is that there have not been local benefits or jobs experienced from the private Amherst wind development, dampening this connection at the smaller scales. This relationship needs to be explored in other contexts with different ownership and benefit regimes, as suggested by Slee (2015).

Additionally, while place attachment has been proposed as an alternative to NIMBYism to explain opposition at the local scale (Devine-Wright, 2009), our study instead found place attachment to the Chignecto region to be a positive predictor of support only in general, but insignificant under controls for the regional or home view scales. Past studies have found that place attachment at the local scale can decrease support for renewable energy infrastructure nearby as people with high local place attachment have greater concern about the impact of new developments on their local landscape (Devine-Wright & Howes, 2010). However, a recent survey of residents living near wind developments in the US found place attachment to be positively correlated with support for local wind development in regression analysis (Hoen et al., 2019). This relationship may depend on how wind turbines are seen to fit with local place meanings, as shown by McLachlan (2009) and Bidwell (2017), something we cannot explore with our data. In our study, residents with high place attachment to the Chignecto region similarly appear to be more supportive of wind energy overall but would prefer it to be developed elsewhere, although they are still not opposed to it locally. More detailed exploration of technological and place meanings, such as undertaken by Bergquist et al. (2020) around transmission infrastructure in the US, would be appropriate in future work.

Local use and export of energy interact

Past research has found that people around wind turbines often report a desire for the energy generated to be used locally (Brennan et al., 2017; Rand & Hoen, 2017). This principle holds true here where a desire for local energy use retains significance in regression analysis for all three scales, only weakening slightly at the home scale. Other than this, the above section shows that factors that have previously been shown to have a significant impact on support for wind energy are weaker in this study.

Instead, a few predictors that have received little prior attention emerge strongly to predict support for wind, especially at local scales. The positively phrased *energy as a commodity* variable is a weak predictor at the general scale but a strong predictor for local support. Although respondents agree more on average that energy generated by the wind farm should be used locally rather than exported (*local energy use* scale mean of 4.3 compared to a mean of 3.0 for *energy as a commodity*), support for wind development above and beyond local needs is an important predictor of support for further development at the local scale. This may suggest that people believe the Chignecto region has enough wind resources to meet their local needs and to develop for export, as in the case of Ireland (Warren et al., 2005). While past studies have found local ownership and use of energy to increase support for renewable sources (Hufen & Koppenjan, 2015), few studies have examined support for developing additional wind resources after local needs have been met. In their study of wind farms in Ireland, Brennan et al. (2017) found lower support for wind development for export as compared to domestic use. However, the proposed wind farms in their study were strictly for export to the UK and they did not explore the option of meeting local needs first and then exporting additional energy (Brennan et al., 2017). It seems clear in our study that the capacity to view energy as a

commodity like any other is important for wind development support, as long as local needs have been met first, which is at any rate how electricity grids typically work.

Predicting support in view of home

The *reminder of energy use* variable is strongest when respondents are considering whether they support wind in view of their home. Recognizing the complexity of any such position (Ellis et al., 2007), this suggests that such critical local support is linked to respondents reflecting about their consumption behaviour, making them willing to live with the visual and other costs of clean energy production. This idea is supported by Adams and Bell (2015) who report that consumers may place a higher value on energy generated by nearby infrastructure, therefore reducing their consumption. Recognising that the energy we use comes with inevitable impacts, and being willing to live with those impacts even within view of home, may be an important point of leverage for renewable energy landscape transitions (Sherren, 2021). The climax thinking framework hypothesizes that exceptionalism or ignorance leads individuals to reject wind energy infrastructure so as to maintain what they see as an ideal *status quo*, an 'insulating' moral framing that does not require them to revise their actions to reduce their impact on future generations or people geographically or socially distant from them (Sherren, 2021). Any action that chips away at such isolationism should reduce climax thinking. One such action is taking responsibility for one's own energy use to host energy infrastructure, but another is to take responsibility for others', i.e. being willing to export clean energy rather than limit it to local use. The strength of both the *commodity* and *reminder* variables confirms the relevance of climax thinking for understanding support for renewable energy at sensitive local scales and suggests the climax thinking framework may have more utility for the identification and exploration of leverage points for renewable energy transition than the more simplistic NIMBY or its variants.

Contrary to much recent work (Brennan et al., 2017; Swofford & Slattery, 2010; Walker et al., 2018), the variables significant in predicting support for wind in view of respondents' home may suggest that it is influenced more by environmental concern and a desire to produce more clean electricity, whoever uses it, than by concern about financial benefits or even jobs. This idea is further supported by the fact that, within the local wind support question set, the statement with the highest mean is, 'I would not mind seeing wind turbines from my home if they are contributing to clean energy and a more sustainable future'. A similar result was found in a nation-wide study in the US, in which the belief that wind energy is effective at combatting climate change was a strong positive predictor of support for local developments (Hoen et al., 2019). In their study of factors influencing support for wind energy, Jones and Eiser (2009) found a belief in anthropogenic climate change to increase support for local wind development from people around proposed sites, but not from the control group. However, Jones and Eiser (2009) note that, while supporters usually focus on the benefits of wind energy at the global scale, including the reduction of greenhouse gas emissions, opponents are often more focused on problems turbines may create locally. Therefore, they suggest that focusing on the negative local impacts of climate change may be effective in combatting local opposition (Jones & Eiser, 2009). The effects of climate change are being felt strongly in the Chignecto area, with rising sea levels and strong storm surges causing flooding, damaging local infrastructure and threatening the historic dykelands (Corfu, 2017). Experiencing these impacts of climate change may be contributing in part to a recognition of the importance of renewable energy amongst Chignecto residents, an idea that could be further explored in future research.

Conclusions

The results of this study provide insight into how the residents living around an established wind farm view wind development in general and near their home, and how the distribution of energy and benefits from wind development influences those views. Although support declines slightly from the general to home view scale, it is relatively high at all three, suggesting residents are generally supportive of wind energy. It is notable in relation to recent emphasis on procedural justice that this relatively high support has occurred despite a dearth

of community consultation, no community ownership, minimal benefits or profits to the community, no reduction in energy rates, and minimal evident job creation. While many predictors behaved as expected when respondents were reflecting on wind energy in general, variables one would expect to be important in predicting support at the local scale (e.g. jobs, local benefits, place attachment, political values, exposure to turbines) had only weak or no statistical strength. Instead, support for more wind development at local scales was related to a willingness to see energy as a commodity, produced for local use as well as export, as well as to agreeing that seeing the turbines was a useful reminder of their own energy use and "that the energy [they] use has to be generated somewhere". Both of these variables are consistent with leverage points hypothesized by climax thinking. Those who support wind energy development in view of their home are those who see renewable energy as a commodity that they can play a role in generating as well as consuming. In contrast with this view, giving renewable energy an exceptional status among our resource industries – hiding it and being miserly with it – works counter to our needs for widespread energy transition.

Additional research is recommended in this and other contexts with a range of ownership and procedural characteristics that would allow us to compare some of the novel variables here with elements of ownership and perceptions of procedural justice. Furthermore, such work could be improved by shifting from typical measures of place attachment to more nuanced assessments of place, the specific technology and its 'fit' in the landscape in question. Finally, these more novel variables around willingness to export and seeing infrastructure as a reminder of energy use should be further tested to establish whether they are similarly correlated with support in other contexts.

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Climax thinking, place attachment, and utilitarian landscapes: Implications for wind energy development

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A B S T R A C T

As a means of understanding responses to landscape change, the concept of climax thinking proposes that communities resist changes because individuals view their current landscape as in its optimal state. We examined perceptions of past landscape change to help predict support for future change in the context of wind energy in the Chignecto area, Atlantic Canada. Change is this region includes a wind farm built in 2012 and the longer-term loss of four landscape features: dykes from the 1600s are being modified due to rising seas, foundries from the 1800s no longer exist, most giant hay barns from the 1800s have collapsed, and radio towers from WWII were dismantled. To assess local responses to these changes, we designed and randomly distributed a mail survey. The survey asked about exposure to turbines, support for wind energy, and demographics. Half the sample received images and descriptions of the four previous features, accompanied by questions about fit in the landscape and sadness at loss. These items were combined to create a climax thinking scale. Regression analysis reveals neither place attachment nor time in the region to be predictors of climax thinking, while male gender and conservative politics increase climax thinking. Conservatism decreases support for wind energy among people who can't see turbines from home and is not significant for people who can. Climax thinking increases wind support among people who can see them from home but is not significant for people who can't. Implications of results for renewable energy transitions are explored.

1. Introduction

Built landscapes, defined as areas resulting from the natural and cultural interactions between the environment and humans, change over time to meet evolving societal needs and objectives (Antrop, 2005; Council of Europe, 2000; Park & Selman, 2011). Renewable energy infrastructure, for example, requires the construction of new, often highly visible utilitarian landscape features such as wind turbines or solar panels (Wustenhagen, Wolsink, & Burer, 2007). These utilitarian landscapes, like wind turbines or fossil fuel pump jacks, represent infrastructure constructed by humans in a landscape to meet a societal need, following the Oxford English Dictionary definition of utilitarian as meaning "useful or practical rather than attractive" ("Utilitarian," 2009, p. 1022). Understanding community perceptions of past and current utilitarian landscape features may help in predicting support for future utilitarian features in the context of renewable energy. Studies have focused on community responses to the addition of renewable energy infrastructure to their landscape (Jacquet & Stedman, 2014; Krauss, 2010; Walker, Stephenson, & Baxter, 2018), but with some exceptions from Europe (Antrop, 2005; Park & Selman, 2011), few studies have examined landscape transitions involving the loss of some utilitarian features and the addition of others. Especially within North America, there is limited research on community responses to changing utilitarian landscape features.

As a backdrop to the study presented here, we build on previous work examining the dynamic nature of landscapes and the ways people perceive and adapt to changes in the landscape (Antrop, 2005; Hanley et al., 2009; Keilty, Beckley, & Sherren, 2016; Park & Selman, 2011). Since the concept of Not In My Back Yard (NIMBY) is now largely discredited as an explanation for public resistance to landscape change (Devine-Wright, 2005; Wolsink, 2006), other ways of understanding public resistance are starting to emerge. Recent work, for example, by Sherren (in press) on climax thinking and work by Devine-Wright (2009) on place attachment offer alternative ways of thinking about place-protective behaviour. With attention to these concepts in particular, we seek to clarify and advance concepts of climax thinking and place attachment as distinctive modes of public concern regarding landscape change.

Our empirical work examines perceptions of utilitarian landscapes and landscape change in Canada using an experimental design within a mail survey distributed to residents in a rural, dyked, historically agricultural region of eastern Canada that has experienced numerous landscape changes in recent decades, including wind energy. Through this study, we aim to answer the following research questions: (1) How do people think about past landscape change? (2) How is (1) related to familiar dimensions such as place attachment, time in place, and politics? (3) How do (1) and (2) influence support for wind energy development? After reviewing the relevant literature on this topic, we

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explore these questions through results of a mail survey conducted in parts of New Brunswick and Nova Scotia, Canada.

2. Place attachment and climax thinking

The theory of place attachment suggests that people or communities have an emotional bond with the locations they live in or visit frequently, and those with stronger attachment will be more likely to resist changes to their surrounding landscapes (Devine-Wright, 2009). Rural environments can inspire particularly strong identity associations for residents and various studies have examined place attachment as it relates to acceptance of landscape change. Park and Selman (2011) found that strong place attachment in rural areas, measured as high levels of affirmative attitudes to rural landscapes, was the strongest barrier to accepting change in these locations. Similarly, Devine-Wright and Howes (2010) compared two towns located an equal distance from an off-shore wind development in Wales and found support for the wind farm to be negatively correlated with place attachment. Chodkowska-Miszczuk, Martinat, and Cowell (2019), Frantál and Nováková (2019) and McLachlan (2009) have found that the socioeconomic context in which energy is installed is important for its acceptability and perceived fit. Rural economies dependent on tourism dollars have been found to be particularly sensitive to visual landscape changes caused by wind energy infrastructure (Sæþórsdóttir and Ólafsdóttir, 2020).

The concept of place attachment as it relates to new landscape developments is further supported by the U-shaped curve of support for wind energy infrastructure proposed by Wolsink (2007). General public support for wind energy is high prior to a specific project proposal, but support within a community often declines following the proposal announcement due to concern about landscape impacts (Wolsink, 2007). Support remains low throughout the planning and construction phases, but usually increases a few years after completion, suggesting that new developments can be disruptive to community members, but that people can often adjust over time and come to accept or even appreciate new landscape features (Wolsink, 2007).

An alternative theory about how people experience their local landscapes over time is proposed by Sherren (in press). The idea of climax thinking suggests that individuals who view their surroundings as optimal—perhaps even intended—are more likely to oppose further changes to the landscape. It echoes the idea of climax plant communities in ecology whereby succession progresses through a predictable sequence of plant communities replacing one another until the ecosystem reaches a stable and dominant plant community, the so-called climax or equilibrium. Sherren (in press) notes that ideas of succession and climax communities in ecology have largely been replaced by non-equilibrium concepts that describe ecosystems as fluid with multiple potential states, and argues that we should do the same with our lived landscapes. Climax thinking has been developed for use in a range of situations when locals resist public good landscape change, particularly sustainability transitions including but not limited to renewable energy. Climax thinking is hypothesised to have temporal and spatial dimensions emerging from ignorance or exceptionalism, including: 1) a lack of awareness of previous landscape change giving an illusion of landscape stasis or a belief that previous landscapes and residents were more primitive; 2) an assumption that current landscape solutions will meet future needs or belief that future residents are less important; and, 3) a blindness to, or lack of concern for, the impacts that can be imposed elsewhere when the wealthy or powerful resist change at home (Sherren, in press). Pasqualetti (2011) discusses a similar concept of immutability in exploring opposition to wind energy, explaining that opposition may arise from an expectation that the landscape should exist permanently in its current state. Leverage points for reducing climax thinking are suggested to include: learning our landscape history without becoming limited by it, learning how to layer landscapes, and building empathy for other lives we impact by our landscape decisions (Sherren, in press).

Climax thinkers may be more likely to resist landscape changes, such as renewable energy developments, believing they will be unable to adapt (Sherren, in press). Fears of inability to adapt have frequently been proven false, however. Communities are often highly adaptable and norms can change over generations, or even within generations as people modify their preferences and expectations of the landscape as has been seen with hydroelectricity (Sherren et al., 2016). Supporting this idea, Park and Selman (2011) found that individuals have consistently highly valued the rural landscape of England, despite the fact that these landscapes have never been static, suggesting that people adapt their preferences for landscapes and that preferences can be learned through the process of socialisation.

Understanding the processes that have influenced past change and the ways people have managed and adapted to alterations in valued landscapes can be useful in planning for future changes (Antrop, 2005). Using past change to understand future change, Krauss (2010) explored wind power in the dykelands of North Germany, explaining that the coastal landscape has resulted from centuries of interactions between humans and the environment, with historical construction and maintenance of dykes used to create agricultural land. The success of wind energy in the landscape similarly resulted from interactions between people and nature in the area as a continuation of the centuries of dynamic constructed landscapes, rather than from a top-down imposition of wind farms on the communities (Krauss, 2010). Similarly, Hanley et al. (2009) examined the impact of awareness of past landscape change on perceptions of current and future forest changes. The study found that as people learned how perceptions of the landscape had shifted over time, these insights increased support for future change in the region (Hanley et al., 2009). Drawing on insights from this study, and other work on landscape preferences (Selman, 2010) and expectations surrounding utilitarian landscapes (Keilty et al., 2016), we present empirical findings below to examine how people see past change in landscapes and how these perceptions are linked to climax thinking and acceptance of wind energy.

3. Methods

3.1. Study area

The Chignecto area, also called the Tantramar Marsh or the Chignecto Isthmus, is located on the border between the provinces of New Brunswick (NB) and Nova Scotia (NS) in Atlantic Canada (Fig. 1). The area is situated on the edge of the Bay of Fundy, an inlet of the Atlantic Ocean and the Gulf of Maine, and includes the towns of Sackville, NB (population 5331) and Amherst, NS (population 9413). The area has a rich and long history of interaction between humans and the environment, including by Mi'kmaq First Nations not discussed in this paper, providing an example of a region that has undergone alterations to the built landscape as the economy and needs of the area have changed. Five significant settler landscape features are explored in this research for which details are provided below.

One of the earliest examples of built landscape in the region is the network of dykes constructed by Acadians (French settlers) beginning in the 1600s to drain the salt marshes and convert the marshland to agricultural land (Fig. 2a). Although the Acadians were deported from the region by the English in 1755, the dykes have been maintained and expanded for centuries, allowing the marshland to be farmed and inhabited by later settlers in the area (Mount Allison University Archives, 2004). Rising sea levels and strong storm surges caused by climate change have caused some dykes to be breached, causing flooding in the region. Climate change models predict that sea levels will rise enough to breach remaining dykes within the next 15–20 years (Corfu, 2017). Some dykes are being reinforced and others are controversially being moved or intentionally breached to return some land to salt marsh, helping to absorb flood water (Lieske & Bornemann, 2011). As the dykes represent a centuries-long interaction between humans and

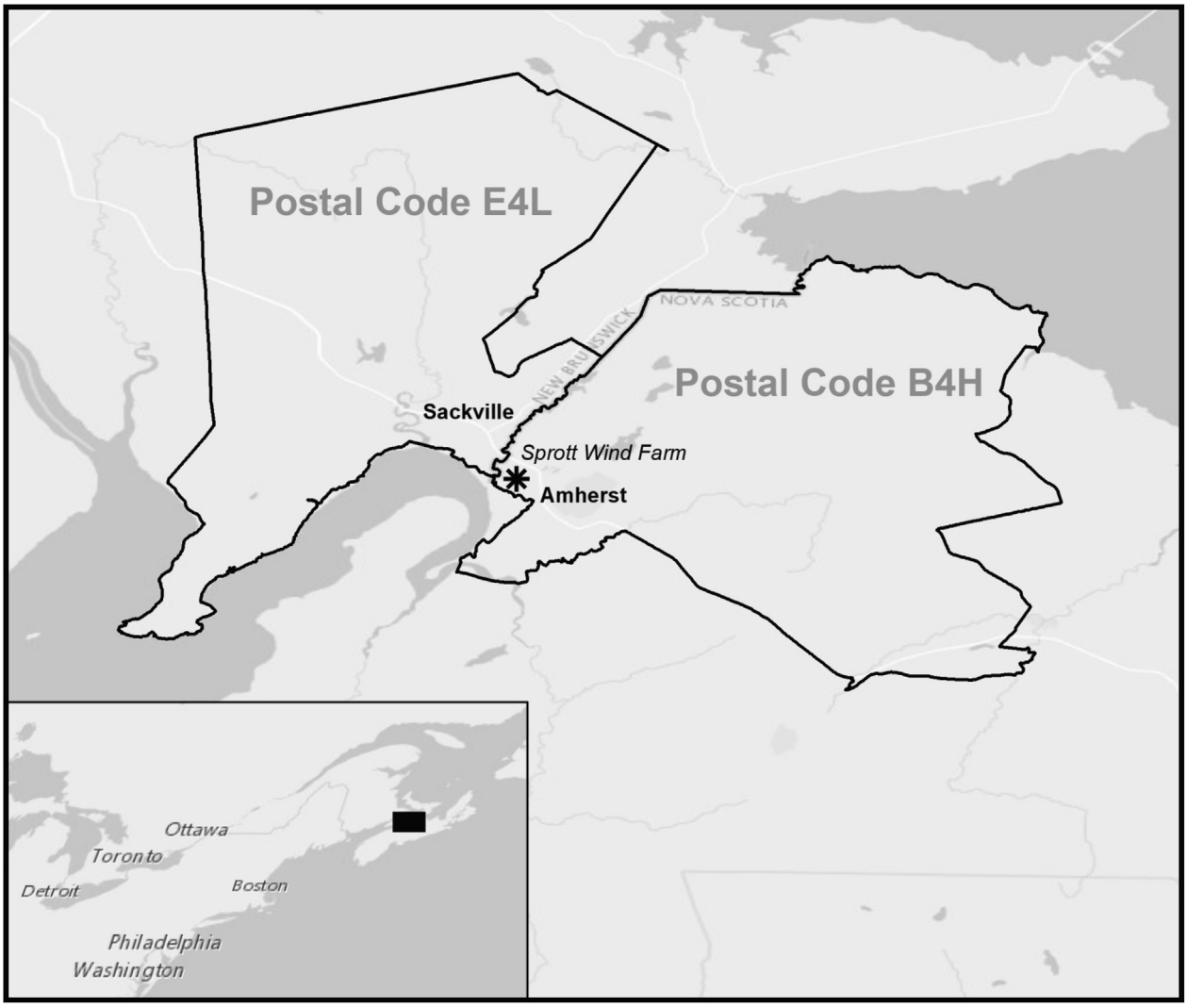

Fig. 1. The study area on the isthmus between Nova Scotia and New Brunswick, including the main towns, the Sprott Wind Farm, and the two postal code (forward sortation) areas included in the survey. Locator map inset shows the region in relation to some cities of northeastern North America. Basemap data was sourced from ESRI, HERE and Garmin, thanks to OpenStreetMap contributors and the GIS User Community.

nature, and changes to them may alter the region's geography, the recent challenges are of significance to many.

Foundries were established in Sackville and Amherst for metal processing in the mid-1800s thanks to local coal and ore deposits (Mount Allison University Archives, 2004). The foundries included several large buildings as well as tall smokestacks (Fig. 2b), some active up until the 1980s. Some buildings were demolished while others were retained but later destroyed by a large fire that occurred in 2012 ("Historic Sackville foundry in flames," 2012, Mount Allison University Archives, 2004). Although some foundry buildings still exist, none of the tall smokestacks remain that were emblematic of the region's history of coal and iron production. Their loss is perceived by some as a loss of industrial heritage.

Hay cultivation was a significant industry in the region throughout the 19th and 20th centuries when horsepower was paramount and the dyked marsh presented ideal conditions in which to grow hay (Mount Allison University Archives, 2004). Hay was stored in large barns (Fig. 2c), and used to feed horses in the area as well as being exported, with over 400 hay barns on the marsh at one time ("Tantramar marsh," 2016). By the 1960's, few hay barns were in use and many began to be dismantled or were slowly destroyed by fire, lightning strikes, vandalism and storms; only 13 remained as of 2016 (Mount Allison University Archives, 2004; "Tantramar marsh," 2016). Older people in the area may remember the barns for their intended use in agriculture, while younger people may have attended weddings or parties held in the barns after they were no longer used for storing hay. Hay barns have become iconic, featured in many photographs and paintings of the region, such as the work of Thaddeus Holownia (Holownia & Lochhead, 1989).

A more recent landscape change in the area was the dismantling of the Radio-Canada International (RCI) towers (Fig. 2d). These towers were built during the Second World War to broadcast radio to Canadian Forces overseas and continued to transmit Canadian radio around the world until 2013 when internet had largely replaced radio (Foster, 2014). RCI made significant efforts to sell the towers but with no buyers they were dismantled in 2014 to sell the land (Foster, 2014). Throughout the decades in which the towers stood, they were widely recognised across the marsh for their distinctive wires and bright flashing lights at night, a landmark to many.

While the four previously discussed landscape changes involved the partial or complete loss of landscape features, wind farms have been a recent addition to the Chignecto Area. This study area was in fact chosen due to the natural experiment resulting from the removal of the RCI towers in tandem with wind farm development in the region. The largest wind farm in the region was approved for construction near Amherst and built in 2012, comprising 15 turbines and with a total

Fig. 2. The landscape photos used in the experimental treatment of our survey instrument, including: a) dyke-building, 1900; b) foundries, 1908; c) haybarn, 2016; and, d) radio towers, date unknown; as well as, e) a photo of the Sprott Wind Farm, 2014, not included in the survey. Photo credits: a) Photographer unknown, Musée virtuel du Canada (http://www.museevirtuel.ca/sgc-cms/histoires_de_chez_nous community_stories/pm_v2.php?id = record_detail&fl = 0&lg = Francais&ex = 00000630&rd = 148367), b) P. Stopps, Canada's Historic Places (https://www.historicplaces.ca/en/rep-reg/image-image.aspx?id=7181#i3), c) P. Rockwell, CBC News (https://www.cbc.ca/news/canada/new-brunswick/tantramar-marsh-hay-barns-disappearing-1.3468265), d) Staff photographer, Telegraph Journal Newspaper (retrieved April 2018, link no longer live: https://tj.news/greater-saint-john/story/36148900/radio-canada-international-shortwave-tow?source=story-related), e) Kate Sherren.

generating capacity of 31.5 MW, enough power to supply approximately 10,000 homes ("Maritime wind" 2012) (Fig. 2e). The Sprott wind farm is located approximately three kilometres west of the Amherst town centre, near the coast of the Bay of Fundy, and approximately ten kilometres southeast from the Sackville town centre (Fig. 1). Due to the flat topography of the marsh, the turbines are visible across much of the area, including from the majority of homes in Amherst as well as parts of Sackville.

3.2. Survey design and implementation

A mail survey was distributed to randomly selected homes in the Chignecto region, designed to measure public support for wind energy and factors influencing this support, including perceptions of past landscape change (Chappell, 2019). Using the multiple reminder mail survey method (Dillman, 1978), we distributed surveys to 1000 randomly selected homes in the region, defined by two postal code Forward Sortation Areas (FSAs E4L and B4A). Address lists were acquired from different sources for the two provinces because of differing data availability: a Georeferenced Civic Address Data Base was used for New

Brunswick (from Service NB via the GeoNB Open Data License), and an Assessed Value and Taxable Assessed Value Dataset (by Proprerty Valuation Services via the DataZone open data website for NS). Random numbers were used to choose a proportional number of addresses from each FSA to receive the survey, 440 and 560 for E4L and B4A respectively.

All questionnaires included questions about exposure to wind turbines, place attachment, support for wind energy at the national, regional and local level, and demographics. Half the questionnaires also contained images and brief descriptions of the four landscape features described above that have been partially or completely lost over recent decades –dykes, foundries, hay barns and radio towers (Fig. 2a-d). Each landscape feature was accompanied by questions asking if respondents had seen the feature, if they believed it fit well in the landscape, and if they were sad at its loss or decline. In addition to these elements of the questionnaire, we also included optional open-ended responses, allowing respondents to elaborate on topics mentioned elsewhere in the survey. The survey was not piloted due to time constraints.

The landscape question set was implemented for two reasons. First, we sought to operationalize the temporal dimension of climax thinking by measuring attachment to past or current utilitarian landscapes, and explore its impact on wind support. Second, we included the question in only half as an experiment to operationalize one of the hypothesized leverage points of climax thinking: whether being reminded of past landscape changes increased support for wind energy development.

The mail survey period began in May 2018, with an initial postcard informing the 1000 randomly selected residents they would be receiving a survey. This was followed by the first copy of the survey, a reminder postcard, a second identical copy of the survey, and a final reminder postcard, each mailed one to two weeks apart. The final reminder postcard was sent in July 2018. All those who responded had the option of entering a draw for a Visa gift card, with the first 100 respondents being entered to win one of five $50 gift cards and all subsequent respondents being entered to win one of five $20 gift cards.

The mail survey achieved a response rate of 40% over the two-month survey period. There were 335 surveys returned completed of the 843 successfully delivered, of which exactly half were the experimental version with the landscape question, proportionally distributed across provinces. Comparing demographics of the survey respondents to census data, the survey population represents the overall population relatively closely, with some noted differences (Table 1). Based on these comparisons, caution should be taken with extrapolating results of this study to younger and less educated residents of the region as well as males in NB.

3.3. Data and analyses

3.3.1. Dependent variables

To explore how people think about past landscape change and how this is related to other concepts such as place attachment, the key variables of interest are those associated with the four historic landscape features (i.e., dykes, foundries, hay barns and radio towers (Fig. 2)): do they believe the feature fits well in the Chignecto landscape, and are they sad at its loss? (Table 2). These questions were asked on a three-point scale: disagree, neutral and agree.

We conduced Principal Component Analysis (PCA) with varimax rotation for questions involving fitness and sadness for the four landscape features. This analysis resulted in the identification of four factors, one for each of the four landscape feature pairs. One scale for each landscape feature was created by taking a mean for each pair of fitness and sadness questions. These four landscape-feature scales are referred to as the DYKE, FOUNDRY, HAYBARN and RADIOTOWER scales. One scale was also created for all eight questions combined by taking the mean response for all eight questions (fitness and sadness for each of the four features). This fifth scale was created to examine overall attachment to past utilitarian landscape features in the region, whether they have been completely lost from the landscape or just partially lost, and is referred to as the Attachment to Vestigial Utilitarian Landscape (AVUL) scale. Vestigial is defined as “forming a very small remnant of something that was once greater or more noticeable” (“Vestigial,” 2009, p. 1156). We use it in this study to mean features that have been lost or partially lost from the landscape, as remnants of the dykes, haybarns, radio towers and foundries remain to varying degrees, but all four have been reduced from what they were at the time of their original use. AVUL represents a preliminary attempt to measure the past orientation of climax thinking. Statistical means were calculated for this variable to moderate the effects from landscape features not seen. Cronbach’s alpha was calculated for all scales from the two questions for each, ranging from a high of 0.87 for RADIOTOWER and a low of 0.29 for DYKE. Relationships between these five scales were then examined using a bivariate correlation matrix with Spearman correlations, a correlation coefficient based on the ranked values of each variable (Table 3).

Table 1
Demographics of survey respondents and model controls compared to census data for postal code forward sortation areas E4L and B4H, using percent (Statistics Canada, 2017).

Census	E4L (Sackville)	B4H (Amherst)	Survey	Sackville (n = 148)	Amherst (n = 187)
Gender					
Female	52.1	53.0	Female	58.5	52.5
Male	47.9	47.0	Male	41.5	47.5
Age					
20–24	6.8	5.7	19–24	2.1	1.1
25–34	11.1	11.6	25–34	8.5	1.7
35–44	14.1	14.4	35–44	12.0	10.1
45–54	17.7	17.9	45–54	14.8	18.4
55–64	20.1	20.5	55–64	28.2	26.3
65–74	15.2	16.1	65–74	17.6	29.6
75+	15.1	13.8	75+	16.9	12.8
Income					
under 25,000	13.3	21.1	< 26,000	12.6	13.1
25000–49999	18.9	28.1	26000–50999	21.0	27.6
50000–79999	22.0	23.6	$51,000 to $75,999	21.8	24.1
80000–100000	10.5	9.8	$76,000 to $99,999	12.6	14.5
100000+	22.0	17.4	$100,000 or more	21.8	20.7
Education					
High school or less than HS	38	46	High school or less than HS	28	26
College or trade apprenticeship	33	39	College or trade apprenticeship	28	41
University undergraduate or graduate	29	15	University undergraduate or graduate	44	33

Table 2
Questions, response options and descriptive statistics for the vestigial landscape-related dependent variables of interest from the Chignecto survey, used to construct the Attachment to Vestigial Utilitarian Landscapes (AVUL) scales. n = 167.

	Descriptive Statistics	
Question/Statement[#]:	% Yes or Agree	Mean (S.D.)
Have you noticed the dykes in the Chignecto area (Fig. 1a)?	84%*	
If yes (*n* = 141):		
The dykes fit well in the Chignecto landscape. (dykefit)	91%**	2.91 (0.29)
I am sad at the loss of the dykelands. (saddykes)	64%**	2.57 (0.61)
Did you live in the Chignecto area prior to the loss of the foundries? (Fig. 1b)	54%*	
If yes (*n* = 91):		
The foundries fit well in the Chignecto landscape. (foundryfit)	41%**	2.26 (0.71)
I am sad to see the loss of the foundry stacks. (sadfoundry)	31%**	2.02 (0.78)
Have you noticed hay barns in the Chignecto area? (Fig. 1c)	95%*	
If yes (*n* = 159):		
The hay barns fit well in the Chignecto landscape. (barnsfit)	90%**	2.89 (0.33)
I am sad to see the loss of the hay barns. (sadbarns)	81%**	2.79 (0.45)
Did you live in the Chignecto area prior to the removal of the RCI towers? (Fig. 1d)	95%*	
If yes (*n* = 159):		
The RCI towers fit well in the Chignecto landscape. (towersfit)	52%**	2.36 (0.73)
I am sad to see the loss of the RCI towers. (sadtowers)	53%**	2.37 (0.75)

* scale is Boolean Yes/No = 1/0
** scale is Disagree = 1, Neutral = 2, Agree = 3
[#] These questions were asked with reference to the photos provided in Fig. 2.

3.3.2. Independent predictors, controls and regression

Using Ordinary Least Squares (OLS) regression we developed a series of models to predict variation in sense of fitness and sadness for the scales noted above. Predictor variables include place attachment, time lived in the region and political orientation. Place attachment was selected as a predictor variable as previous studies have found it to be a significant factor influencing opposition to landscape change (Devine-Wright & Howes, 2010) and to examine whether the concept of climax thinking (as measured by AVUL) is independent from place attachment. Place attachment to the Chignecto was measured using five questions adapted from Raymond, Brown, and Weber (2010). Specific statements were reverse coded as needed and averaged to create a scale from one (low place attachment) to five (high place attachment). Details for predictor variables are summarized in Table 4.

Time lived in the region was used as another predictor as previous studies have found place attachment to be influenced by years in a region, with people who have lived in an area for longer having greater attachment to their surroundings (Brown, Perkins, & Brown, 2004). Time in the region was measured through a written response question asking respondents the number of years and months they have lived in the Chignecto, then converted to decimal years (Table 4).

Finally, political orientation is a common predictor of support or opposition to landscape features. For example, Baldwin and Lammers (2016) found that people with conservative politics demonstrate a greater preference for the past and tradition, while non-conservatives show stronger support for future opportunities. Options on the questionnaire for political orientation were provided in relation to the four dominant political parties within the region: Conservative, Liberal, New Democratic Party and Green; as well as an option for Other. For the analysis reported in this study, we created a dichotomous variable for 'Conservative' in comparison with respondents who identify as not conservative. Control variables include age, gender, education and household income. The demographic data from the survey control questions also allowed the survey population to be compared to the overall population of the region, using Statistics Canada data from 2016, reported in Table 1.

3.3.3. Support for wind development

Three scales were created from three survey question sets designed to measure support for wind energy development at different geographic scales (Table 5). The first question set, asked prior to the experimental section of the survey, measures support for wind energy development in general and at the national level. A single scale called GENERAL was created from this question set based on the unidimensionality revealed in PCA (alpha = 0.81). The next wind support question sets were asked after the experimental section of the survey. The first explores support for wind energy at the regional scale, i.e. the Chignecto area. Again, a single scale called REGIONAL was created from five questions based on the unidimensionality revealed in PCA (alpha = 0.91). The final question set, also asked after the experimental section, was designed to measure support for wind energy development at the local scale, within view of respondents' homes. PCA factor analysis again revealed one dimension and one scale was created, the HOME VIEW scale (alpha = 0.88). Bivariate analysis was used to examine if support for wind energy is impacted by any of the above variables, including the experimental treatment.

Table 3
Bivariate correlation matrix for vestigial landscape-related scales for each landscape feature and all four features together created by combining fitness in landscape and sadness at loss (Spearman rho values).

Scales	DYKE	FOUNDRY	HAYBARN	RADIOTOWER
DYKE (*n* = 140, α = 0.29, $\bar{x}$=2.74, sd = 0.37)	–			
FOUNDRY (*n* = 89, α = 0.82, $\bar{x}$=2.14, sd = 0.70)	0.285**	–		
HAYBARN (*n* = 158, α = 0.77, $\bar{x}$=2.84, sd = 0.36)	0.303**	0.284**	–	
RADIOTOWER (*n* = 158, α = 0.87, $\bar{x}$=2.37, sd = 0.70)	0.368**	0.393**	0.272**	–
AVUL (*n* = 167, α = 0.76, $\bar{x}$=2.56, sd = 0.37)	0.607**	0.812**	0.495**	0.795**

**significant at 0.01.

Table 4
Questions, response options, and descriptive statistics for the key predictor independent variables of interest from survey of Chignecto area. n = 335.

Questions/Statements	Distribution (%)					Mean (S.D.)
Years in region: How long have you lived in the Chignecto area?						40.7 (21.9)
Place attachment: Likert scale response options from 1 (strongly disagree) to 5 (strongly agree)	1	2	3	4	5	
The Chignecto area means a lot to me.	0	1	13	38	48	4.32 (0.75)
I live in the Chignecto area but do not feel attached to it.*	35	39	14	10	2	2.05 (1.04)
I feel the Chignecto area is a part of me.	1	8	24	39	28	3.84 (0.96)
I identify strongly with the Chignecto area.	1	9	24	38	28	3.82 (0.98)
I would prefer not to live in the Chignecto area.*	45	39	11	4	1	1.76 (0.85)
Place attachment scale Cronbach's alpha	0.88					3.99 (0.84)
Political views: What party best represents your political views, whether or not you vote?	1	2	3	4		
Response options: Green (1), NDP (2), Liberal (3), Conservative (4).**	11	16	40	37		

* negatively phrased, reversed for scale
** percentages add up to greater than 100 as some respondents selected multiple responses (eg. Liberal and Conservative)

4. Results

4.1. How do people think about past landscape change?

Regarding landscape features in the experimental section of the survey, 84% of respondents report having noticed the dykes, 54% say they have lived in the area prior to the loss of the foundries, 95% have noticed the hay barns and 95% lived in the area prior to the removal of the radio towers (Table 2). All features are perceived as fitting in the landscape, and their loss causing sadness, but to differing degrees. The dykes, which have been around the longest, have the highest mean agreement of fitness, at 2.91 out of 3, while the loss of hay barns causes the highest reported sadness, at 2.79. The foundries have the lowest mean for fitness (2.26) and sadness (2.02).

The relationship between years in the region and noticing features was examined using Spearman correlations (Table 6). The correlation between years lived in the region and the noticing of features is weakest for hay barns (rho = 0.14), likely because a few hay barns remain in the region, and people may notice them even if they moved recently to the area (Table 6). The correlation is also weak for dykes (rho = 0.17), likely for the same reason since many dykes remain in the region. The correlation is the strongest for the foundry smoke stacks (rho = 0.38), as this feature no longer exists.

Table 6
Spearman correlations between years lived in region and of noticing features (n = 167).

Landscape feature	Rho value	P-value
Dykes	0.1692	0.0398
Foundry	0.3825	0.0000
Hay barns	0.1374	0.0971
Radio towers	0.2259	0.0058

4.2. How is AVUL related to variables such as place attachment, time in place and politics?

Overall, people in the Chignecto area report high place attachment, with a mean of 4 out of 5 on the place attachment scale (Table 4). There is a positive correlation between place attachment and years lived in the region (Spearman rho = 0.27, p < 0.00), suggesting that people who have lived in the region for longer derive a greater sense of identity

Table 5
Questions, response options and descriptive statistics for support for wind energy development at three different scales.

Statements	Descriptive Statistics					
Likert scale response options from 1 (strongly disagree) to 5 (strongly agree)	1	2	3	4	5	
GENERAL wind support n = 331	Distribution (%)					Mean (S.D.)
2a. Wind energy is a cleaner alternative to fossil fuel energy.	0	1	6	29	64	4.56 (0.66)
2b. Canada is already overbuilt with wind farms.*	0	1	13	45	40	4.23 (0.75)
2c. Wind energy is an economic opportunity.	1	3	12	42	40	4.17 (0.88)
2d. Wind energy development is unnecessary because we have enough other sources of energy in Canada.*	1	2	6	47	43	4.29 (0.78)
2e. Wind energy should be further developed in Canada for environmental reasons.	2	2	10	43	43	4.22 (0.88)
Canada Wind Support Cronbach's alpha	0.81					4.29 (0.61)
REGIONAL wind support n = 330						
5a. I would be happy to see more wind energy development in the Chignecto area.	2	14	17	38	39	4.09 (0.93)
5c. I would like to see no wind turbines in the Chignecto area.*	2	2	9	36	51	4.31 (0.89)
5d. Wind turbines do not fit well in the landscape of the Chignecto area.*	2	3	16	39	39	4.09 (0.95)
5e. I would like any current wind turbines in the Chignecto area to be removed rather than replaced after they reach their 25-year life span.*	2	3	9	39	47	4.27 (0.87)
5f. I believe wind turbines are a negative addition to the Chignecto landscape.*	2	3	12	38	45	4.20 (0.93)
Chignecto Wind Support Cronbach's alpha	0.91					4.19 (0.79)
HOME VIEW wind support n = 330						
6a. I would prefer not to see wind turbines from my home. *	6	12	26	38	18	3.51 (1.09)
6b. I think wind turbines can be beautiful and wouldn't mind having a view of them from my home.	4	11	22	47	17	3.63 (1.00)
6c. Wind turbines can be a useful landmark and tell me I am getting close to home.	4	6	25	47	17	3.67 (0.96)
6d. I would not mind seeing wind turbines from my home if they are contributing to clean energy and a more sustainable future.	3	5	9	53	30	4.04 (0.90)
6e. I think that wind turbines near my home would have a negative impact on my health. *	3	6	24	40	27	3.83 (0.99)
6f. Seeing wind turbines from my home would ruin my view. *	3	7	16	46	27	3.87 (1.00)
Home View Wind Support Cronbach's alpha	0.88					3.76 (0.79)

* reversed

Table 7
OLS regression predicting attachment to past utilitarian landscape features (standardised coefficients).

Variable	DYKE ($n=66$)	FOUNDRY ($n=40$)	HAYBARN ($n=72$)	RADIOTOWER ($n=73$)	AVUL ($n=77$)
Predictors:					
Place attachment	0.030	0.132	0.280*	0.015	−0.049
Conservative	0.163	0.502**	0.139	0.327*	0.403**
Years in region	−0.114	−0.068	−0.331	−0.101	−0.137
Controls:					
Male	0.215	0.357*	−0.051	0.132	0.274*
Age	0.251	−0.389*	0.068	0.169	0.007
Income	0.265	−0.266	−0.341*	−0.118	−0.110
College/trade^	−0.308	−0.090	−0.293	−0.194	−0.214
University ^	−0.545*	−0.345	0.009	−0.269	−0.239
Constant	2.462	2.641	2.941	2.341	2.827
Adjusted R^2	0.141	0.297	0.109	0.095	0.102

^ Dichotomous with high school/ less than high school as reference.
* significant at 0.05.
** significant at 0.01.

from the area. Of those who answered the politics question, 73 people identify as conservative and 125 identify as not conservative (Table 4).

We used OLS regression to predict attachment for each of the landscape features and the combined AVUL scale (Table 7). Place attachment is a significant predictor for the HAYBARN scale only. Conservatism is positively correlated with the FOUNDRY scale, the RADIOTOWER scale and the AVUL scale. Years lived in the region is not significant for any of the five scales. Examining control variables for each of the five scales, having a university education is negatively correlated with the DYKE scale. For the FOUNDRY scale, being male is positively correlated, while age is negatively correlated. Income is negatively correlated with the HAYBARN scale, and no control variables are significant for the RADIOTOWER scale. For the AVUL scale, being male is the only control variable significant, with a positive correlation. The strongest model is for the FOUNDRY scale, despite the low *n* of this scale, with an adjusted R-squared value of 0.279.

4.3. How does AVUL influence support for wind energy development, compared to other variables?

Support for wind energy from people in the Chignecto region is positive at all three scales, and is highest at the GENERAL scale (mean = 4.29), followed by REGIONAL (mean = 4.19) and then HOME VIEW (mean = 3.76) (Table 5).

Examining predictors of wind energy support, we separate people who can see wind turbines from their home and people who cannot. Beginning with people who can see turbines (Table 8), place attachment is significant and positive for GENERAL and REGIONAL but is not significant for HOME VIEW. The AVUL scale is significant and positive for REGIONAL and HOME VIEW but not for GENERAL. Years lived in the region, conservative politics, and the experimental treatment are not significant for any of the three wind support scales for people who can see wind from their home.

For people who cannot see wind turbines from their home, place attachment has a significant positive correlation with GENERAL but is not significant for REGIONAL or HOME VIEW. The AVUL scale is not significant for wind support at any level for people who cannot see turbines from their home. Years lived in the region has a significant negative correlation with REGIONAL and is not significant for the other two scales. Conservative politics has a significant negative correlation with GENERAL and REGIONAL and is not significant for HOME VIEW. Again, the experimental treatment is not significant for any of the three scales.

5. Discussion

Our survey explored attachment to past utilitarian landscapes in the Chignecto area and its implications for current and future changes in the context of wind energy. The climax thinking framework has temporal and spatial dimensions, each of which proposes different reasons why people may be resistant to local landscape changes including those needed to advance sustainability such as renewable energy. The past dimension is tackled here, specifically how people relate to infrastructure which has been technologically superseded and whether a reminder of past changes causes people to see new changes (i.e. wind) as just the newest in a long sequence of changes made to meet evolving needs. We examine these interests in more detail below.

5.1. Strong attachment to utilitarian landscape features is evident

Respondents believe all four landscape features explored in this study fit well in the landscape and are sad at their loss, despite the four features being diverse in both structure and history. In general, based on high Cronbach's alpha values of the five scales, if a person believes a feature fits well in the landscape, they also don't want it to be removed, suggesting a resistance to overwrite past landscapes to make space for new needs. Each of the four historical landscape features were built to meet a societal need at the time of construction, but none are optimally

Table 8
Spearman correlations with support for wind at three scales for people who can and cannot see turbines from their home.

	Can see from home				Cannot see from home			
Predictor:	*n*	GENERAL	REGIONAL	HOME VIEW	*n*	GENERAL	REGIONAL	HOME VIEW
Place attachment	132	0.3214***	0.2387**	0.1124	194	0.1934**	0.1407	0.1252
AVUL	72	0.1484	0.2320*	0.2604*	94	−0.1050	−0.0838	0.0721
Years in region	125	0.0173	0.0414	0.0615	184	−0.1459*	−0.1608*	−0.0607
Conservative	72	−0.1057	−0.0272	−0.0387	120	−0.2839**	−0.3233***	−0.0681
Experimental treatment	132	0.0508	−0.0548	−0.0497	195	0.0071	0.0143	0.0391

* significant at 0.05.
** significant at 0.01.
*** significant at 0.00.

serving such needs today. As in studies of end-of-life dam removal (Fox, Magilligan, & Sneddon, 2016; Keilty et al., 2016), our findings demonstrate the attachment community members can form to anthropogenic landscapes, even when these landscapes are no longer serving their intended purpose. Even objectively quite toxic features like coal slag heaps can shift from simple utility to become a part of residents' cultural identities (Price, 2018). Such attachment drives resistance to overwriting those landscapes through feature removal or modification or the addition of novel features like wind turbines.

The morphology or associations of the features do seem to matter in terms of attachment. Responses to FOUNDRY and RADIOTOWER are less positive and more varied than responses to the HAYBARN and DYKE scales. Furthermore, the correlation between FOUNDRY and RADIOTOWER (rho = 0.393) is the highest correlation between any of the four feature scales, suggesting people who have attachment to the foundries also have attachment to the radio towers, despite their very different uses. The foundry smokestacks and the radio towers share certain physical characteristics, as tall, industrial towers that are not shared with the dykes or hay barns, which are agricultural and may appear more natural or less intrusive in the landscape because of the size and materials used. The greater variation in attachment to the foundries and radio towers may be due to residents' different interpretations of technology in the landscape. McLachlan (2009) explores interpretations of place and technology in the context of renewable energy, arguing that interpretations differ among people and influence how well they believe a development fits in a place. The foundry and radio tower features are the most technologically modern, and regression reveals associations with those variables and gender and conservatism. Male gender is positively associated with FOUNDRY and is the only demographic control that is significant in the overall vestigial landscape scale regression.

Conservatism is also significant in predicting the combined attachment scale (AVUL), with a stronger association than gender, as well as in the models related to FOUNDRY and RADIOTOWER. That conservatism is associated with overall feature attachment is not surprising; previous studies demostrate that Conservatives have a greater focus on the past, while Liberals are more future-focused (Baldwin & Lammers, 2016; Robinson, Cassidy, Boyd, & Fetterman, 2015). Robinson et al. (2015) studied news websites and State of the Union addresses in the US and found that Conservatives reference the past more than the future while Liberals do vice versa. Similarly, Baldwin and Lammers (2016) found that framing environmental issues as lost heritage increased environmental concern among Conservatives, explaining that Conservative ideology emerged from a desire to protect the *status quo* against progressive change. In this study Conservatives also demonstrate a preference for preserving landscape features even beyond their utility. The attachment of both males and Conservatives to the foundries and radio towers may suggest potential framing strategies for wind turbines or other renewable infrastructure as continuations of the region's industrial heritage and technology in the landscape, potentially helping increase acceptance among people who may not otherwise support renewable energy.

5.2. Attachment to utilitarian landscape features is independent of place attachment and time spent

Regression analysis suggests that our aggregate measure of attachment to vestigial landscape features (AVUL) is independent from both time lived in the region and place attachment: place attachment is not a significant predictor for any of the five scales except for HAYBARN ($p < 0.05$). This suggests that being attached to the Chignecto area itself is different from attachment to the specific features it holds. In the chapter where climax thinking is first presented, it is described in part as potentially an inverse framing of place attachment that views such 'steady state' ideas of place as a barrier to sustainabilty transitions (Sherren, in press). In this first attempt to 'measure' the past dimension of climax thinking, it is helpful to learn that it is not redundant with such extant concepts. The average level of place attachment found in the Chignecto area is similar to that found by Raymond et al. (2010), but they also found a significant positive relationship that we did not see between time lived in the region and place attachment in their study of the Adelaide and Mount Lofty Ranges in South Australia. Other studies have also examined the relationship between years in the region and place attachment (Brown et al., 2004), but climax thinking is a distinct concept in this literature.

5.3. Wind farms can become part of the climax landscape

Shifting our focus to future change, we ask what insight this new understanding of attachment to utilitarian landscape features brings for understanding the acceptability of wind energy in the region. Returning again to the climax thinking concept (Sherren, in press), it appears that wind farms have become part of the climax landscape of those who can see it from home, and they might not mind seeing more of it. Place attachment is a significant predictor of support for wind development at the GENERAL (national) scale for everyone, but it is only a good predictor of support for more wind in the region for those who can currently see turbines. This result contrasts somewhat with research suggesting that high place attachment may result in opposition to nearby developments due to the social-psychological disruption caused by these developments (Devine-Wright, 2009). The bigger question is often what predicts willingness to have turbines in view of home. It is notable then that overall attachment to utilititarian landscape features is a significant positive bivariate predictor of support for wind development at the REGIONAL and HOME VIEW scales only for respondents who can see turbines from their homes. Our findings thus suggest that turbines may become a part of people's climax landscapes: residents with higher attachments to historical landscape features similarly develop attachment to new features and support further development of these features. These results support theories of acquired aesthetics (Selman, 2010) and shifting baselines explored in the context of hydroelectricity (Keilty et al., 2016) in which local residents develop attachment to anthropogenic landscapes over time.

Support for wind among those who cannot see turbines is influenced by political views. Published studies have found conservatism to be negatively correlated with environmental concern (Davidson & Haan, 2012), but there is more at play here. In this work political views do not have a significant impact on support at any scale for residents who live within view of turbines, suggesting these people base their support on personal experience with turbines rather than their general beliefs. Clarke et al. (2016) found similarly in the US around hydraulic fracturing ('fracking') that political views increased in influence on opinion the further away from fracking activity, that in the absence of direct experience, political alignment is an important heuristic. Closer to home this is consistent with Walker et al. (2018) who surveyed residents within a two-kilometre radius of turbines in NS and Ontario and found support from residents living near turbines in NS to be significantly higher and less politicised than in Ontario, where renewable energy was implemented in controversial ways colouring public opinion (Fast & Mabee, 2015).

Within our analysis, the experimental treatment (being presented with the pictures of recent landscape change) does not have a significant impact on any of the three wind support scales. This outcome contrasts with results of Hanley et al. (2009), who found knowledge of past landscape change to increase support for future change in the context of forest cover. Our experimental treatment may not have been adequately strong, but the citizens in this area are also likely more familiar with the landscape changes we included than were the participants of the Hanley et al. (2009) study, as the Chignecto residents inhabit theirs. It may also be, however, that being reminded of past landscape changes induces the opposite effect: increasing resistance to change by inducing fears of future changes. This issue requires further

research with larger samples and different experimental treatments and designs, as well as different landscape changes, for instance urban densification or coastal retreat.

6. Conclusions

This study operationalizes the past dimension of climax thinking, measuring attachment to vestigial utilitarian landscape features to empirically probe the subtle distinctions between attachments to historical landscape features, broader conceptions of place attachment and implications for wind energy. Through studying people's attachment to features associated with past needs, which in this area is generally high, we can better understand how they may respond to recent and future change in the landscape such as renewable energy infrastructure. Results suggest that climax thinking, in the context of attachment to features associated with past needs, is independent from place attachment and time lived in the region. The significance of gender and politics on attachment to past utilitarian landscapes, particularly the foundries and radio towers, suggests opportunities for framing future wind energy or other such developments as continuations of the region's industrial heritage. Preliminary analyses of implications for wind farm development suggest that factors influencing support differ between people who can and cannot see turbines from their home. People who can see them seem to include turbines in their attachment to utilitarian features, and not mind having more, while people who cannot see them base their support or opposition on broader political beliefs.

In this area where wind support is generally high, and perhaps the memory of past landscapes is strong, the experimental treatment had no effect, but it remains an area for potential further research. More immersive experimental treatments could be used to convey not only past landscape changes but the experiences of people who initiated and lived through them, humanizing them and by so doing reducing climax thinking-driven ideas of previous generations as primitive. Replication of such methods of testing past-oriented climax thinking is needed in different geographies and context, and with larger samples, as well as explorations of how it influences responses to scenarios of a wider set of possible future changes. By understanding the factors influencing acceptance of change in landscapes and the adaptability of people to such change, we can ease transitions to the kinds of developments in landscapes that will be required in coming decades to meet and sustain societal and environmental needs.

CRediT authorship contribution statement

Ellen N. Chappell: Conceptualization, Methodology, Investigation, Formal analysis, Funding acquisition, Writing - original draft, Visualization. **John R. Parkins:** Methodology, Validation, Supervision, Writing - review & editing, Visualization, Funding acquisition. **Kate Sherren:** Conceptualization, Methodology, Supervision, Writing - review & editing, Visualization, Funding acquisition.

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	Public Perception Match Empirical Evidence? https://www.researchgate.net/publication/264725640_The_Effects_of_Wind_Turbines_on_Property_Values_in_Ontario_Does_Public_Perception_Match_Empirical_Evidence_Reply	significantly impacted nearby property values, both rural residential and farm properties.
Property Value	Canning Consultants Inc and John Simmons Realty Services Ltd. (2010), *Wind Energy Study – Effect on Real Estate Values in the Municipality of Chatham-Kent, Ontario* http://canada.wpd.de/fileadmin/pdfs/PropertyValuesConsultingReportFeb42010-Ontario.pdf	Wind turbines in Chatham-Kent, Ontario have not significantly impacted nearby property values in rural residential areas.

PROTECT WENTWORTH VALLEY

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March 1, 2022

We firmly believe global warming is an existential crisis that demands the world's attention and immediate action. However, industrializing Wentworth Valley with gigantic Wind Turbines, while perhaps well intended, is an action that will create more harm than good. We are providing some recommendations for the bylaw development below but ask that the Municipality prohibit wind turbines in this narrow, picturesque and unique piece of land in Cumberland County.

The Municipality of Cumberland's Policy 4-53 in the Municipality Planning Strategy document could address this. We request that Council amend the Wind Turbine Restricted Overlay to add the Wentworth Valley as a tourism area and therefore no large- or small-scale wind turbines would be permitted in this area. (Baseline Road to Hunter Road). That would protect this area from the constant threat of Wind Turbines.

Our Bylaw recommendations address changes to current bylaws and additions to the bylaws. We have divided our recommendations into sections on siting requirements, decommissioning, accountability, and telecommunications.

Siting requirements/location conditions

Section 5.1.3 Table 3 (a) Minimum separation distance amend to "best in class" minimum of 5,000 meters:

http://www.wind-watch.org/documents/eoliennes-sons-et-infrasons-effets-de-leolien-industriel-sur-la-sante-des-hommes-wind-turbines-noise-and-infrasound-effects-of-industrial-wind-energy-on-human-health/

Section 5.1.3 Table 3(c), and 5.1.3 Table 3(g) Minimum Separation distance should be minimum of 5000 meters.

Comment: This setback request of 5000 meters is the most critical ask. This should ensure there are no issues to residents and visitors for sound (audible and infra), flicker, views, ice throw and other physical and mental health concerns.

It also provides opportunity to "repower" (defined as replacing older generally smaller wind turbines with newer, generally larger more efficient designs) the site as it could potentially handle larger turbines in future RFP's. This is more environmentally proactive and prevents any unnecessary future disturbance of our land.

5.1.6 – amend to minimum of 5,000 meters

5.1.7 Change Subsection 5.1.6 to subsection 5.1.3 (C)

5.1.8 - dealt with if the setback is set at minimum of 5,000 meters. Noise and other impacts.

5.1.20 Add section (h) application must be co-signed by the registered property owner if the land upon which a Wind Turbine is proposed to be installed and operated is not owned by the Owner and or Operator of the wind turbine.

Add: Prohibit two or more Wind Turbine Projects (One proponent with multiple turbines and one construction time frame) in close proximity to 5 or more residences where the residences are within 1 km of each other. This will reduce the negative and **cumulative** impacts on residents (noise, flicker, health, environment, peace and enjoyment of the land)

Add: Wind Turbine only noise should be no greater then 25 dB(A) as measured outside within 50 meters of existing residences.

The bylaw on Noise standard needs to address the items as outlined in Attachment A. We consulted and received input on Noise from a professional engineer who has a lived experience with noise issues in Nova Scotia. There was a lack of proper bylaws addressing noise issues.

Comment: The Wind Turbine Noise bylaw will require extensive research and due diligence to properly protect the residents. “Ambient sound levels in rural areas can be quite low especially at night. On the logarithmic decibel (dB) scale an increase of 10dB is perceived as a doubling of the noise level. An increase of 6 dB is considered to be a serious community issue. Since a quiet night in the country is typically around 25dB, the common claim by wind developers of 40dB at the nearest home would be perceived as a noise almost 4 times louder than normal. The disruption of sleep alone presents serious health and human rights issues. We believe that the noise level from wind turbines should not be at a level that it disturbs residents sleep”.

https://www.wind-watch.org/faq-noise.php

Decommissioning-Additions

Because decommissioning costs are typically incurred when the project is no longer generating revenue, securing funds ahead of time to cover these expenses is imperative and must be part of the project permit.

Prior to the approval of construction of any wind turbines, the proponent prepares a Decommissioning Plan that becomes part of the project permit.

Decommissioning Plan should be updated every 5 years after the project begins operating and submitted to the Development Officer for review and approval.

The bylaw must include a Decommissioning Security (paid for by the proponent) to cover all decommissioning costs in the manner prescribed by 5.1.19. If for any reason the Proponent is not able or willing to complete the prescribed decommissioning, the proceeds of the bond will instead be provided to the Municipality in which each turbine resides to fulfill the satisfactory

decommissioning (need to determine how this happens… options could include beneficiary).

All above ground components as outlined in 5.1.19 of all wind turbines must be removed at the end of the project unless proof it is to be repowered. Bylaw 5.1.19 should include in the restoration process removal of the concrete to at least 48 inches below the surface and return roads to reasonable natural state in the timeline outlined.

Proof that the Decommissioning Security is in good standing (amount and payments) needs to be submitted annually to the Development Officer.

Decommissioning should be enforced when the turbine stops producing power for 6 months or the project term is complete. Decommissioning should be completed within 12 months of both of these periods.

Comment: The average decommissioning cost per turbine currently is $744,800 Canadian:

The Cost of Decommissioning Wind Turbines is Huge - IER (instituteforenergyresearch.org)

https://www.wind-watch.org/documents/three-estimates-of-decommissioning-cost/

Accountability-Additions

Approved wind turbine projects must have a qualified surveyor or engineer inspect each turbine location to ensure it conforms to the site plan in the approved application and the bylaws prior to any concrete being poured. Once the concrete is poured, a second inspection is performed to confirm approved turbine pad locations.

Wind turbine Municipal bylaws must be reviewed at a minimum of every 5 years.

The residents of the Municipality of Cumberland should also be protected by a Community Protection Fund held by the Municipality in the event the proposed project fails to meet the stringent standards that the bylaws put forth regarding setback, flicker, noise etc. Currently there is no way to hold any wind turbine proponents responsible for failed studies and incorrect project developments. This must be rectified to protect residents from Wind Turbine Development. A suggestion for the Fund value could be a % of the project costs.

Damages could take the form of negative impacts to health, diminished property values, and environmental. It is noted that science is evolving on the negative impacts on health from infra and audible noise, shadow and flicker. Compensation for those affected when new evidence is found to account for people's illness should be include in definition of damages.

All project developers should also hold Liability Insurance in which the Municipality of Cumberland and its residents are also named on it.

In the interest of the accountability to the community there needs to be a Review Committee comprised of members from Council, Development Officer and public before an application is approved. Currently Development Officer has the final word for the go ahead on the applications received

An annual report to the Municipality indicating the performance of each turbine's MW's produced versus MW's sold to NSPI as proof that the turbines are still functioning.

The tax payer should not be required to fund any accidental damage done to roads, lands or waterways caused by the construction of the turbines. The bylaws need to hold the proponent responsible and have all repairs completed in a timely manner (timely should be defined).

5.1.20 ADD (h) - Evidence of notification to existing Telecommunication Companies

In 2016 the CRTC declared telecommunications services as "essential". Development of green energy wind turbine projects should not be detrimental to these types of services. Wind Turbine Project applications to the county for development should include proof of EMI/RF testing in conjunction with all telecommunications providers within a 20 km radius of all turbines. This letter of proof should be accompanied with a letter from the telecommunications provider with their acceptance of the planned locations of the windmills as non-detrimental to telecommunications services. This is similar to any Environmental Assessment plans – acceptance is given only if both parties are in agreement there will be no detrimental results to current operations.

Wind turbine noise bylaw problems and recommendations

Prepared for Protect Wentworth Valley by Kristen Overmyer, M.S.M.E
February 28, 2022

Problems

Every problem has one or more solutions. By describing the problems encountered by others, I hope to stimulate discussion that creatively identifies other possibilities.

Council noise objectives for residents not clear

- Where on the resident property is it acceptable for wind turbine noise to be audible?
  - Anywhere on the property
  - Within 30 meters or some other distance from the house
  - Inside the house with windows open
  - Inside the house with windows closed
- At what level
  - Less than or equal to 30 dB(A) (Please see Appendix A: "How this document uses noise levels")
  - At a level that disturbs the residents' sleep
- For what time of day or night and for how long

Wind turbine setbacks place all risk on residents

"As of right" setbacks place all the risk on the resident. As long as their turbines are placed equal to or greater than the setback, the resident has absolutely no remedy regardless of how severe the noise intrusion.

Complaint resolution process unspecified.

Process for filing a wind turbine noise complaint not clear. What information must be provided. To whom is the complaint given. The Colchester bylaw, in contrast, does supply some information.

How testing triggered not specified. A complaint was submitted to Antigonish County under their bylaw. A staff person (Development Officer?) from Eastern District Planning Commission with no engineering knowledge denied testing based upon the noise levels that were measured and provided in the complaint did not exceed the background noise levels reported in the proponents Environmental Assessment (EA) documents. These noise levels were obtained from microphones placed in trees during the autumn several kilometers away from the resident's house; this was profoundly absurd. This background noise assessment had not been prepared by an acoustical engineer but by an individual with BAs in economics and geography working for Stantec. His methods and conclusions belied any grasp of basic, acoustical engineering principles and the county was already advised of this fact. The development officer's conclusion also displayed an ignorance of fundamental statistics. An average is a property of a *set* of samples and cannot be ascribed to any member of the set as he assigned the average background noise level obtained from a fatally flawed EA study to the resident's location.

Noise testing protocols to be used in the event testing is triggered were not specified. A *professionally recognized* noise testing protocol should be established. The "Ontario protocol for wind turbine noise" is an example of such a protocol.

No appeal process in the event the resident (or wind project proponent) contests the testing results.

Testing issues

Uncertainty on how to measure a sound level: Municipalities may specify a sound level not to be exceeded such as 36dB(A). However, they do not specify how this is measured. Is it a maximum level, a ten-minute average, a one-hour average?

Protocol deficiencies: While the Ontario NPC-350 protocol is far superior to how NSE proposed to test the noise at a residence in Antigonish County (Glen Dhu wind project), it has issues as well.

1. The protocol is ambiguous in places and at times requires the reader to pull information from different sections to be sure as to what was intended.
2. Some equipment specifications are presented as recommendations and should be upgraded to today's requirements for large turbines**.**
3. Wind speeds for testing wind turbine noise are limited to 10 m/sec at 10 meters elevation at the receptor site. Industrial scale wind turbines are capable of operating at significantly greater wind speeds and so the full range of noise emissions is not considered.

Conflict of interest: Engineering firms, *make money from wind companies* by preparing computers models of predicted noise levels for environmental assessments and performing post construction noise testing.

Governance in general issues

Argument from authority: Government bodies usually make decisions based on "Argument from authority." For example, NSE will point to HC and say they are the experts. These experts are generally kept at arms length from the public so they cannot be directly questioned. The logical flaw in "Argument from authority" is that it contains the implied premise that the authority so cited is infallible. On its face, this premise is false.

Lack of credible response: There is nothing in act or regulation to require any governing body (provincial or municipal) to respond with credible countervailing evidence and reasoned argument to challenges or questions from a plaintiff**.**

No deadlines: Regarding wind turbine noise testing, there are no time requirements on governing bodies (provincial or municipal) to manage timelines for noise monitoring or to respond within a reasonable period for answering questions from the public or wind proponent.

Burden of achieving action on Wind Turbine Noise issues falls on public

It's been my experience that for the public to receive any reasonable action on the part of government to resolve a wind turbine noise issue, they must go to extraordinary lengths and cost to *push* the government to take action.

Recommendations

To some degree, the Colchester bylaw addresses some of the foregoing problems. As such, it might offer itself as a framework or starting point that you may be able to amend sufficiently with some of the information that follows.

Clarify the goal

The public should get their council to ***commit*** to the location on a property, the level, and duration of wind turbine noise they will be subjected to. The council in response should make clear statements in the bylaw as to what they consider to be acceptable for residents living in proximity to wind turbine power plants to experience. For example (Note: I'm not suggesting the goals below should be the ones accepted by residents):

- Wind turbine noise may be audible but not exceed a 35 dB(A) maximum within 30 meters of a residence at any time of day.
- Wind turbine noise shall not reach instantaneous levels that disturb a resident's sleep in their home at night with the windows open any time of day or year.

Setbacks and operational requirements

Setbacks should be a necessary *but not sufficient* condition for operating the wind power plant. Council should specify a minimum distance that any wind turbine must be from a residence (or property line depending on the goals they establish above). This minimum distance should then be *coupled* with one or more operational sound level requirements such as a maximum sound level to be measured outside the residence. For complaints involving claims of sleep disruption, I would also recommend low frequency noise measurements inside the home (e.g., bedroom).

Setback data

What we know: Wind turbine noise was measured at audible levels by the UK Noise Association inside a Wales farmhouse 3 km from 3 Nordstrum 1.3 mw wind turbines. UKNA-WindFarmReport Blaen Bowi.pdf (page 15)

A home in Pictou County experienced noise at a level it could be heard over the television inside a farmhouse at 1.44 km distance from a single Enercon 80, 2.3 MW wind turbine at the Glen Dhu project.

There are other examples that I can provide.

Setback factors

Total sound power: Given different size (megawatts) and model wind turbines have different total sound power output, basing the setback on this parameter may be useful. For example, depending on the council's stated goals, units having an output of 104 dB(A) might require a 2.5 km setback. Every 6 dB(A) increase in a unit's total sound power over 104 would require a doubling of the distance (i.e., a 110 dB(A) unit would require a 5 km setback)**.**

Number of dominant wind turbines: Setbacks typically do not take into consideration the number of wind turbines a residence receives significant emissions from such as a residence in front of a line of turbines. Such a residence will experience higher noise levels than a residence near a single dominant turbine at the same distance. There is a resident in Bailey's Brook facing the line of Glen Dhu turbines on the Antigonish escarpment more than 2 km away; it was not unusual for them to experience wind turbine noise inside their home.

Goal dependency: The appropriate setback is dependent upon the council's goals regarding what noise level a resident is expected to experience and the frequency of resident complaints (that those levels are being exceeded) to which the council is willing to respond with testing. Given the number of variables, the answer is statistical, that is it is a matter of probability. To the extent council wishes to minimize complaints, they should increase the setback.

For example: assuming council wishes to prevent wind turbine noise (110 dB(A) total sound power per wind turbine) inside a home at levels that disturb sleep and limit noise levels just outside the home to 36 dB(A) (Colchester level), a 5,000 meter setback from a residence (as opposed to property line) should reasonably reduce *but may not completely eliminate* violations of council's goals and the need for noise testing.

Noise limit

Goal dependency: The noise limit and method of measurement to verify compliance is dependent upon the goals the council sets regarding what a resident is expected to experience as discussed above.

Measurement method dependency: The noise limit's relationship to what a person might hear depends upon how the noise is measured and has mainly to do with the time period over which the noise is measured and averaged. The "short" setting on a sound level meter averages the noise measured over 0.5 seconds while the "long" setting averages the noise measured over one second. The latter will smooth the pulsations (amplitude modulation) typical of wind turbine noise. Other average times can also be specified such as one minute, ten minutes, one hour, 24 hours or even one year.

40 dB(A): A 40 dB(A) noise limit measured on the long setting would still permit noise that is *clearly audible* outside a home and depending on the context may be found to be an annoyance by some people going about their normal activities outside their home. NSE and some municipalities have set a precedent of 40 dB(A).

36 dB(A): Colchester County's 36 dB(A) noise limit measured on the long setting would still produce audible noise outside a home. However, it would be less noticeable and statistically should result in fewer complaints. *Hence, striving for the 36 dB(A) precedent set by the Colchester County bylaw would be worthwhile.*

25 dB(A): The literature does document rural background noise levels as low as 25 dB(A). If the council's goal is that the noise just outside the home is to *never be audible*, then consideration of noise limits at this level are indicated.

Noise inside home: Please note, a 40 dB(A) (or 36 dB(A) for that matter) noise limit (based on the long setting) outside a residence *may* still result in noise levels *inside the home that could disturb sleep*. For some homes, particularly wood frame, there is a frequency at which the transmission loss from outside to inside is nearly zero. This effect has been documented at the Shirly Wind Farm in Wisconsin and has been noted in the 2015 Council of Canadian Academies (CCA) report on wind turbine noise. The phenomenon is most likely due to the resonance properties of the structure and its room volumes. There are techniques in the literature for measuring low frequency noise inside a room (also cited by the CCA). If one of the council goals is that WTN should not be audible inside the home or at levels that disturb sleep, then these techniques may be useful in determining compliance in conjunction with any outdoor measurements.

Weighting: While the literature cites problems with A-weighting accurately representing human noise perception in the low frequency noise context as presented by wind turbine noise, sufficient, generally accepted work in C, and Z weighting to establish standards as regards wind turbine noise has not been performed and is a subject for further research.

Relationship to testing: Historically, the relationship between a noise limit (e.g., set by NSE or a municipality) and the way it is measured has been a point of confusion. NSE specifies a one-hour average which they *understand* to be a contiguous hour measurement. The Ontario Protocol Part D uses a one-hour average as well. However, it is an average of 60 one-minute samples collected at specific wind speed ranges over a period of two or more weeks. *These do not yield the same result.* The NSE interpretation is a "hit or miss" proposition; one must get lucky to catch the turbines at their loudest. The latter is a statistical approach that more reliably approximates representative noise levels at the various wind speed ranges.

Noise complaint process

Triggering a noise complaint

Application: The bylaw should specify the types of information to be included in the complaint such as the plaintiff's contact information, where the noise was heard (inside, outside, near house, on property), time of day, duration, etc. and the effects on the plaintiff, e.g., sleep disruption, annoyance, etc. For greater certainty, the county might require the complaint to also be sworn as an affidavit. The complaint could be filed directly with the county's Development Officer (DO) or with the plaintiff's district councillor who would immediately forward it to the DO. The DO does not have the option of *rejecting* the complaint.

Application processing: I'm suggesting the county's Development Officer (DO) manage the complaint as most counties have one. Upon receiving the complaint, the DO shall timestamp and screen the application for completeness and accept or return for more information.

Test trigger: The Cumberland County noise bylaw sets the precedent of the noise being "audible at a point of reception" as triggering the complaint process. From the bylaw:

> 3. "No person shall engage in any activity which is likely to generate noise or sound that unreasonably disturbs the peace and tranquility of a neighborhood. For the purpose of this section, evidence that one person is unreasonably disturbed by a noise is prima facie evidence that the neighborhood is unreasonably disturbed by the noise."
>
> 4. Without limiting the generality of section 3, the activities or noises listed in Schedule "A" during the prohibited times as set out therein are deemed to be activities which are likely to generate noise or sound that unreasonably disturbs the peace and tranquility of a neighborhood if the sound resulting from the activity is audible at a point of reception.

The DO should *not* be given any subjective discretion to reject the complaint as DOs, in general, do not have the requisite knowledge in acoustical engineering.

Screening process

Purpose: The first step in compliance verification should be a screening test. The test's objective is to determine a noise level obtained under a worst-case condition which is the maximum noise level sample when the resident finds the wind turbine noise problematic (wind turbine and ambient noise together) and the minimum noise level sample when the resident does not find the noise problematic (ambient noise only). The result can only be compliance or further, more detailed testing required; "noncompliance" cannot be a result of the screening test. As a screening test, it is considerably less expensive than a full compliance test.

Selecting a tester: The process for selecting the person or organization to perform the test bears discussion amongst the public and council. At a minimum, the chosen person or company must be approved by the plaintiff.

Funding: Given the substantial tax revenues generated by a wind power plant, I'm recommending the county earmark a significant amount of money for funding monitoring and enforcement activities. Screening tests should fall under this fund.

The test: For this purpose, I recommend the Ontario Protocol Part C3. It's a resident triggered test, requires limited data and data processing, does not require the turbines to be turned off and when performed correctly should give dependable results. Note that the samples collected in this screening process are 10-minute, A-weighted averages.

The results: For each step in the noise testing protocol, the report prepared by the testing entity should provide any required data and a description as to how the testing entity performed the step or fulfilled the requirement. The tester should clearly specify and support their findings as either compliance or requiring further, more detailed testing. The tester shall deliver all data and a complete report to the DO within 10 business days of completing test data acquisition.

Review: See “Review process” below for further recommendations on this process

Compliance process

Purpose: The second step in the compliance verification process, if indicated by the screening test results, is a detailed, compliance test. Unlike the screening test, this test can determine non-compliance in addition to compliance. Its purpose is to statistically evaluate the wind turbines only noise level as distinct from the combined wind turbines and ambient noise level which include other wind induced noise such as rustling leaves and grass at the receptor site. To do this, it compares a statically significant number of noise samples at various wind speeds for both when the wind turbines are operational and when they are parked (i.e., ambient noise only).

Selecting a tester: See same section above.

Funding: Funding of the test should be provided by the wind project owner.

The test: For this purpose, I recommend that the Ontario NPC-350 Part D protocol be followed. While it is not perfect, it is a professionally recognized protocol and does have precedence in its use throughout Canada. I can also supply several recommendations for amendments that clarify and strengthen the protocol. Note the noise samples collected for this test are averaged over one minute. These samples, taken over a period of several weeks, are then grouped into 1 meter-per-second wind velocity “bins” representing 4 through 10 meters per second wind velocity as measured at 10 meters above ground at the receptor site. Within each wind velocity bin, a minimum of 60 samples are averaged. Samples are collected and processed in this manner for the wind turbines operational and parked. For each wind velocity bin, the average noise level parked is logarithmically subtracted from the average noise level operational.

The results: For each step in the noise testing protocol, the report prepared by the tester should provide any required data or results and a description as to how the testing entity performed the step or fulfilled the requirement. The tester should clearly specify and support their findings as the wind facility being either compliant or noncompliant with the maximum allowed noise level. The tester shall deliver all data and a complete report to the DO within 20 business days of completing test data acquisition.

Review: See “Review process” below for further recommendations on this process.

Review process

Principles: The bylaw should provide for a test results review process wherein both the wind proponent and plaintiff have access to all and the same information and have sufficient time to review and prepare a refutation of the test results. Key principals in this process are:

1. access to all information by both the wind proponent *and* the plaintiff
2. allowing sufficient time to both parties for review of the test documentation and for preparation of any refutation evidence, argument, and documentation
3. clear definition of what constitutes a defect in the tester’s data or report
4. time limits on the DO for carrying out each step of the review process so it does not drag on indefinitely

Upon receipt, the DO shall timestamp the test data and report. Then, within 2 business days, the DO shall distribute copies of the test data and report to both the wind project proponent and plaintiff.

Both the wind project proponent and plaintiff have 20 business days to accept or refute the report’s findings. Either or both party’s failing to respond within the specified timeframe will by default confirm that party’s acceptance of the report and its results.

If either party refutes the findings, they shall provide, in writing to the DO, evidence and argument that support one or more allegations of defect in the test data and/or report within 20 business days.

A defect in the data or the report is defined as any deviation from the protocol including but not limited to:

1. failure to use required instrumentation
2. failure to properly calibrate, configure or deploy instrumentation
3. failure to prescriptively follow instructions on data acquisition, filtering, and analysis
4. errors in calculations
5. omission of information required to be reported

A defect can also be a failure to follow standard engineering practices as regards proper utilization of acoustical measurements systems and their data.

In the event the DO receives refutation documentation from either wind proponent or plaintiff, the DO shall timestamp said documentation and forward to the testing person or organization within 2 business days.

The testing person or organization may within 10 business days accept or reject in writing the allegations of defects in the data or report. Failure to respond within the specified period will by default confirm the tester's acceptance of the allegations.

In the event the tester accepts the allegations as true either in writing to the DO or by default, the DO shall, with the plaintiff's permission, restart the Screening or Compliance Process whichever the case may be within 2 business days. Said process may or may not result in the retaining of the same tester.

In the event the tester rejects the allegations, they must provide in writing countervailing evidence and argument to each of the allegations. Upon receiving said documentation, the DO shall initiate the arbitration process that follows within 2 business days.

Arbitration process

The following is a proposed framework for arbitrating disagreement between the tester, wind proponent, and proponent as to the veracity of the tester's data, report and findings.

Selecting an arbitrator: There is ample documentation on the Internet regarding a process for selecting an arbitrator. For example: https://law.missouri.edu/arbitrationinfo/2015/10/14/how-are-arbitrators-chosen/ There are, in my opinion, two key requirements that need to be met in the selection process:

1. The prospective arbitrator must demonstrate competency in matters of acoustical engineering. This may include but is not limited to engineering degree, professional experience, or license. A professional engineering license is not required.
2. Both the wind proponent and the plaintiff should be provided the prospective arbitrator's vitae and approve their being selected.

Documentation availability: The DO should ensure that the wind proponent, plaintiff, and arbitrator have received all relevant documentation such as the test data, test report, proponent's or plaintiff's refutation documentation, tester's rejection of allegations documentation. The DO shall deliver said documentation to all parties no later than 3 business days from the selection of the arbitrator.

Stakeholder input: Both the wind proponent and the plaintiff may within 10 business of receiving all requisite documentation provide to the DO additional evidence and argument which the DO shall timestamp and immediately forward to the arbitrator and other party. Once the DO can confirm that all parties have received all requisite documentation including any additional stakeholder input, the DO shall record the date of arbitration initiation and inform all parties of the date.

Arbitrator's decision: The arbitrator shall review *all* documentation including the additional stakeholder input and then make a decision as to whether the tester followed *all* protocol and standard engineering practices or not. The arbitrator shall deliver said decision to the DO no later than 20 business days following the arbitration initiation date as set by the DO.

Decision announcement: Upon receiving the arbitrator's decision, the DO shall within 1 business day, make known to the tester, wind proponent, and plaintiff the arbitrator's decision. In the event, the arbitrator finds *all* allegations of tester's deviation from the protocol or engineering practices to be false, the tester's report and findings stand. In the event, the arbitrator finds one or more of the allegations to be true, the tester's findings will be changed to "indeterminant" and the DO shall restart the Screening or Compliance Process whichever the case may be within 2 business days with the plaintiff's permission. Said process may or may not result in the retaining of the same tester.

Noncompliance mitigation requirements

What: In the event, the "Compliance process" above finds the wind power plant to be noncompliant, then one or more wind turbines must be decommissioned or relocated to bring the plant back into compliance. This is reasonable. The wind energy company is responsible for knowing all federal, provincial, and county requirements and for locating turbines in the project's design such that all said requirements are met. Indeed, during the review and approval processes at the various levels of government, the company warrants that their design meets said requirements. If they make errors that produce a design that fails to meet a requirement, *the consequences of those errors should not be borne by the residents but by the company that made the errors.* Under these circumstances, failing to require the decommissioning or relocation of wind turbines would constitute a variance granted without due process.

How: In Nova Scotia, wind power companies are required to file environmental assessment documents that include computer modeling of sound levels at receptor sites in the vicinity of the proposed wind power plant. These same computer models can be used to facilitate the relocation of wind turbines. For example, if for a plaintiff's residence the computer model calculated a 34 dB(A) noise level (which meets the county's 35 dB(A) requirement for example) and the compliance test yields 39 dB(A), then their model is shown to undercalculate noise levels by 5 dB(A) (39 – 34). The wind company can then remove or relocate one or more wind turbines in the computer model such that the result does not exceed a new limit of 30 dB(A) at the receptor site in question. The reduced 30 dB(A) limit adjusts for their computer model's underestimating noise levels by 5 dB(A). The county's reapproval process would be initiated upon their submitting the new design.

Appendix A: How this document uses noise levels

A provided noise level value such as 40 dB(A) is meaningless without specifying the manner in which the noise is to be measured. For example, the “short” setting on a typical sound level meter averages the noise measured over half a second while the “long” setting averages the noise measured over one second. The latter will smooth the pulsations (amplitude modulation) typical of wind turbine noise. Other average times can also be specified such as one minute, ten minutes, one hour, 24 hours or even one year.

In this document, I use noise level values to provide a common reference point for both the proposed screening test and the proposed compliance test. These tests are described in detail by Part C3 and Part D respectively of the “Ontario Compliance Protocol for Wind Turbine Noise”. In the context of the screening test, the sound pressure level measurement is averaged over 10 minutes. In the context of a compliance test, the sound pressure level value represents the average of 60, one-minute averaged measurements which may be taken over the course of several weeks for a particular range of wind speed (e.g., 5.5 meters/sec to 6.5 meters/sec).

Dear all,

I am writing to express my concern with respect to the proposed international industrial wind development projects in the Wentworth Valley Area. This is not the right place for wind turbines.

One of the projects is a 100MW site on Higgins Mountain / Stevens Mountain, on the high ridge from the top of Folly Mountain west of Highway 4 down into the Wentworth Valley. This development would consist of 18 industrial wind turbines that are 190 m (623 ft) high to the tip of the blade. They are twice the height of the tallest building in Halifax, Fenwick Tower; giants compared to those currently operating in our province and each is as high as a 57-story building. A second 100MW industrial wind turbine project is being proposed on property approximately 6kms Northwest of Debert including 16 to 20 industrial wind turbines. This project affects property from the Folly /Hart Lake area southeast of Highway 4, bordered by East Folly Mountain and moving back towards Central and East New Annan. These are projects currently proposed and do not reflect future proposals that would further the risk to the environment and quality of life in our communities.

Many residents of Londonderry, Folly, Wentworth, Westchester, and surrounding areas from Cumberland and Colchester counties support renewable energy and its importance for the environment. However, there are implications with these massive turbines for everything from wildlife degradation, endangered species, interference with all aspects of telecommunication services, huge environmental concerns, and general disregard for the citizens and visitors in this area for the peace and enjoyment of the land, and economic development.

The impact on the Wentworth Valley area would be catastrophic and irreversible.

We have outlined below many of the concerns expressed at the Protect Wentworth Valley Community Meeting held on November 27th and the Higgins Mountain Wind Project Community Meeting held on December 4, 2021 for your review and consideration. In summary, most attending believe sustainable wind projects may be of benefit in some areas of NS, but the Wentworth Valley is not the place for these massive projects:

1. **Loss of habitat and fragmentation.** Due to 18+ (623 ft tall) turbines, and the new power lines, widened roads, new roads, blasting, gravel pits, concrete foundations, and substations will have a huge impact on all creatures living in that wilderness.

2. **Biodiversity.** Conservation scientists recognise the wind project area as a critical bio-diversity connectivity area in NS to connect species with the rest of North America. As such the area should be protected and not developed with new roads and clear-cuts for turbines. Nova Scotia's endangered mainland moose frequent the area seasonally and travel through the project area as they connect between the Wentworth Valley Wilderness Area and the Portapique Wilderness Area. In late November the NS government released a long-delayed recovery plan for the mainland moose. Mainland moose are at a critical juncture of species recovery and one of the key challenges in these efforts is lack of

natural habitat. There is very little good core moose habitat in NS. However, the wind project areas are on essential core moose habitat. Projects of this size could be a direct threat to the survival of mainland moose.

3. **Future Tourism based development.** Wentworth is a rare gem for outdoor mountain recreation and enjoyed by about 100,000 visitors annually from across the Maritimes. Covid-19 pandemic has proven people need to get outdoors for mental and physical health. There is no other recreation area in mainland NS that offers what the Wentworth Valley does. This turbine project could seriously impact future nature-based tourism development in an area that is known for its outdoors…. quiet hiking trails, snowshoeing, cross country skiing, downhill skiing, snowmobiling, kayaking, mountain biking and fishing. We need to preserve the special areas we have and develop wind farms in remote and less used areas where the human and environmental impacts could be dramatically minimized.

4. **Local Content and Economic Benefit.** The land lease benefits of both projects go to the Indonesian-based owners of Northern Pulp, who inherited a $75,000,000 NS taxpayer loan that purchased the property, and who is now suing NS taxpayers. The 3-year construction phase could possibly bring a few local benefits but there would very little long-term economic opportunity to local stakeholders. Tax revenues would be attractive to cash strapped municipalities but there are thousands of hectares in those same municipalities with excellent wind regime that do not threaten the significant local tourism industry. Wentworth area tourism and outdoor recreation has driven a flurry of homes to be built in the area in the past twenty years that brings significant tax revenue to the local governments. This is desirable tax revenue as well to the counties by land users who demand little to no services. These projects could limit future land development for outdoor recreational activities and home development. Wind turbine projects have an end date and wind energy trends appear to be moving offshore.

5. **Property values.** Proponents acknowledge property values usually drop when new wind projects are built. The last few years have seen increased housing and cottage building in the area due to the outdoor and recreational opportunities. These projects certainly could result in less housing/cottage development due to decreased property values which is one of many reasons that turbine projects are not developed in residential and recreational activity land. Our counties will miss out on the tax revenues of such development. Also, when land values go down, then county property taxes must go down.

6. **Telecommunications services.** To rural areas is paramount especially highlighted in our current pandemic. These projects will have impact on the delivery of these services. Landowners and local businesses are not willing to sacrifice these services for turbines. There are four telecommunications companies that provide essential services, tax revenue and permanent jobs in the proposed project areas of Colchester, Cumberland, and East Hants counties.

7. **Health & Mental Health Effects.**The Covid pandemic has exacerbated access to care in an already over taxed and under resourced mental health care system in Nova Scotia. Most will wait many months

for care of common mental health issues. Engaging in the natural environment and being in nature has been recognized as being a valid tool to managing stress, anxiety, and maintaining good mental health. During the pandemic, there has been exponential growth in people pursuing the outdoors, particularly natural areas that allow for reflection, meditation and exercise**.** Wentworth has long been a hotspot in the Maritimes for getting people outside in fresh air for exercise, relaxation and immersion in deep nature. The past two years have reminded everyone how important nature is for good physical and mental health.

The proponents have done little to ensure no ill health effects will be cast on the residents and thousands of visitors of Wentworth and the surrounding communities. Without testing of such large turbines close to residential homes and businesses, how can we be provided with assurance? Studies confirm more research is required into health and mental effects of industrial wind farms from noise, ruined scenic views, and flicker. Light pollution impacts on natural areas include; stress, anxiety, sleep disturbance, nausea and dizziness. The proposed turbines have never had their effects tested here. What are the cumulative effects of 18+ untested towers in this unique amphitheater like area so close to population density? Wind turbines in the proposed location have the potential to contribute negatively to mental health and the burden of mental illness in Nova Scotia, issues that already weigh heavily on Nova Scotians, their health care providers and health care system.

8. **End Of Use**. Presently there is no requirement for decommissioning bonds to ensure the area is returned to its previous state at end of life. The current 3 turbines in this area linked to one of the proponents have not turned a blade in 3 years and despite being non-conforming to municipal by-laws the tear down or decommission is yet to happen. Not a good sign for the future. How will decommissioning at end of life of the equipment be addressed?

9. **Size and Scale of the project.** The scale of these 100MW turbine projects is the largest that has ever been installed in Nova Scotia and not tested yet in environments such as the Wentworth Valley areas with amphitheatre-like characteristics. How can projects of this magnitude be developed in a small narrow valley like Wentworth without proper testing? The testing does not involve actual industrial wind turbines on our unique terrain. How accurate can these types of tests be? Other wind turbine projects in NS gave assurances to residents that the turbines were properly tested and residents would not hear noise and see flicker. We know this not to be true. Some residents near wind turbine projects in NS have had to move and sell their property at a loss to escape the loud noises and flickering. Others, who have stayed, live with migraines, nausea, and anxiety daily due to no recourse through their county. Set backs for noise and flickering through By-Laws were not appropriate for the size of the turbines to prevent these noise and sight issues. Why would Nova Scotians want to be guinea pigs without testing? Who bears the result if the impacts are severely detrimental to species, health, etc.?

10. **Visual Resources**. Visual sightlines are a recognised area of concern in an Environmental Assessment for wind projects in Nova Scotia. However, the province does not offer much in the way of regulation and guidance for projects such as this. This should not be confused with "not in my backyard arguments". Visual sightlines are views with historical, scenic, cultural, and economic importance. The Wentworth Valley Scenic Loop as designated by the province (reference the sign at the entrance to Scenic Wentworth Valley) as a place with the oldest ski hill east of Quebec and a recognised high value

tourism area for skiers, hikers, bikers, fishers and home owners alike. These concerns have not been taken into consideration by the proponents. There is plenty of land to develop turbine operations … why would it be developed in a strong residential and recreational mecca in NS?

11. **Intensified Industrialization of the narrow valley.** This small valley is already subject to a major quarry, primary rail line serving all of Nova Scotia, industrial forestry and now proposals for the largest industrial wind turbine projects in the province. Was the cumulative impact of these elements considered in the siting?

12. **Higgins Mountain Windmill Project**. Held a community meeting in Wentworth on Tuesday October 5, 2021, to provide information to and receive information from the people living in the community who would be most affected by this project. For some, it was the first they had heard of such project. For others who work full time, it was not possible to attend. It was very apparent from the meeting that they were not well prepared. There were 3 maps that were presented and all three were different. Questions about the placement, number of turbines, and site lines were not able to be answered by the project partners. Each level of government requires different permitting applications and studies for such projects to proceed. The consortium partners did not seem to understand nor explain the processes except that an Environmental Impact Study was required and is being done. This has caused considerable concern that a project with significant implications for this area is not taking the community concerns seriously. On December 4, 2021 Higgins Mountain Wind Proponent held a second community meeting. It was quite evident from the meeting that there is little community support for the Higgins Mountain project. Their 10-minute allocated question period expanded into 2 hours with multiple concerns on this project. Most in attendance were not in support of this project in the Wentworth Valley.

    There has not yet been a community meeting with the other proponent.

Protect Wentworth Valley ASKS of the Nova Scotia Government:

- **Prohibit industrial wind turbines** in areas of important moose habitat and connectivity in Colchester/ Cumberland, which includes Higgins Mountain and Stevens Mountain. Wentworth Valley is not the right place for industrial wind turbines.

- **Enact Protection of the mainland moose core habitat** designated in Colchester/Cumberland, which includes Higgins Mountain and Stevens Mountain, in the Nova Scotia Mainland Moose Recovery Plan.

- **Designate** the Colchester/Cumberland core habitat area of the endangered mainland moose, which includes Higgins Mountain and Stevens Mountain, **as wilderness area under Nova Scotia's Wilderness Areas Protection Act,** to connect to the Portapique River and Wentworth Valley Wilderness Areas. This will help the Nova Scotia Government meet its **mandate to protect at least 20% of the total land and water mass of Nova Scotia** for nature conservation by 2030.

Thank you so much for taking the time to consider this important issue. The above implications to the Wentworth Valley need extensive research and consideration. We hope that after considering the impacts to the Valley you will agree that this project should not be in the location proposed. Wentworth Valley is a treasure to be protected now as wilderness by the province of Nova Scotia.

Respectfully submitted,

PROTECT WENTWORTH VALLEY

Dear Cumberland County Planning Department,

I understand that Cumberland County has placed a moratorium on wind development until its bylaws can better reflect the changing technology affecting current and future wind energy projects. This letter is in response to the Municipality of Cumberland's request for public input.

In drafting changes to the bylaws, I request changes addressing – setback distances, ensuring that funds are available for decommissioning, accountability, regulatory monitoring and a Community Protection Fund.

I would like the setbacks to be at least 5,000 meters to the nearest property line or residence. This distance should help lessen the impact of noise (including infrasound and amplitude modulation), flicker, visual impact, ice throw, and structural failure. These noise concerns from industrial scale turbines have become a concern around the world as wind development has proliferated especially in Europe. Proper setbacks will eliminate the issues many countries are now experiencing from wind turbines. We need to learn from those that have gone before us.

I also request that the issue of decommissioning be addressed by the requirement for a Decommissioning Bond. Currently, there are five wind turbines in Cumberland County which have not been functioning for several years. All proponents should be required to have a bond in place to cover the costs of decommissioning wind turbines. This should not be the responsibility of the tax payer. Nor should the tax payer be required to fund the remediation of any damage done to roads, lands or waterways caused by the construction of the turbines. The Municipality should be the beneficiary in the event that the proponent is unable or unwilling to perform the decommissioning responsibilities.

Another issue is accountability. Currently the option to approve a project lies with the County's Development Officer. In the interest of accountability to the community, there should be a Review Committee comprised of the Development Officer, members of Council, the planning department and the public before granting approval to any wind project.

If approval is given, then as in any development, there should be site inspections done by a qualified surveyor or engineer to ensure that each wind turbine conforms to the approved site plan. These site inspections should be done throughout the construction process - prior to and after the pouring of concrete as well as the installation of the turbines. Inspection reports should be posted for the public record.

The residents of the Municipality of Cumberland should be protected by a Community Protection Fund established by the proponent. This Fund could be a percentage of the project cost and would be held by the Municipality. The purpose of this Fund would be to adjudicate

and pay out claimants who establish that they have suffered damage as a result of the failing to meet the stringent standards that the bylaws put forth regarding setback, flicker, noise etc.

Damages could take the form of negative impacts to health, diminished property values, and environment.

Prohibit two or more Wind Turbine Projects (One proponent with multiple turbines and one construction time frame) in close proximity to 5 or more residences where the residences are within 1 km of each other. This will reduce the negative and cumulative impacts on residents from multiple wind projects in a small area. (noise, flicker, health, environment, peace and enjoyment of the land).

Wind Turbines must have an Ambient Degradation Noise Standard no greater then 25 dB(A) as measured at existing residences. WHO recommends 30dB but for rural settings it is recommended to be 25 dB(A).

Municipality of Cumberland's Policy 4-53 of the Municipal Planning Strategy. Council should consider amending the Wind Turbine Restricted Overlay to add the Wentworth Valley as a tourism area and therefore no wind turbines would be permitted in this very valuable and narrow part of the valley.

There are many issues to be considered in the creation of a county's bylaws to address current and future wind turbine projects. The suggestions above consider the issues which most significantly affect residents within the Municipality of the County of Cumberland.

In closing, thank you for the opportunity to be part of the process.

Best regards,

Protect Wentworth Valley
info@protectwentworthvalley.com
proectwentworthvalley.com

Hello,

As a Dalhousie student, I am very concerned about the imminent impacts of climate change. I feel increasingly concerned about my future as a young adult and this matter weighs heavily on my mind. I am relieved to hear that Nova Scotia has set a target for 80% of our electricity to be generated from renewable energy sources such as wind energy by 2030 in an effort to reduce our carbon emissions as a province. Rapid transition to clean energy is what we urgently need!

However, it worries me to see that Cumberland County is pausing wind energy development permits for 6 months to a year to review its bylaws. Any further delays or roadblocks to renewable energy adaptation will potentially cause the provincial target to slip away, and it is of utmost importance to ensure that good wind energy projects can still proceed. Covid 19 should not be cause for delay as time is not on our side.

Besides subjective views on aesthetic pleasure, the impacts of wind farm installations to recreation and ecotourism is unclear and may even be a net benefit. Any impacts from potential noise or shadow flicker can be easily mitigated by appropriate setbacks to homes. Given that the relationship between wind turbines and human health has little to no correlation, other concerns that have been brought up include effects on local biodiversity and community living. However, the land area needed to install wind turbines is minimal compared to the large patches of land that has already been clear-cut for pulp and paper operations. Furthermore, this also reduces the need to destroy more forests to mine for coal in Nova Scotia.

The benefits that come with installing wind projects that lead to cutting of emissions helps the larger problem at hand. Climate change has been linked to extreme temperatures and increasing forest fires that will cause much more destruction to local biodiversity than the installation of wind turbines. The benefits to the local community also cannot be understated. The developer has promised significant financial support for the local economy via a community benefits fund, as well as contracting and employment opportunities for local people and businesses. This is in addition to over $20 million in tax revenues estimated over the life of the project.

As a Masters of Resource and Environmental Studies student, we are made aware of the importance of good policy to the decarbonization of energy production. However, when the province has set clear regulations to move towards a cleaner future, it is disheartening to see that a moratorium on wind farm development is taking place and cohesive wind projects are being discredited. 6-12 months is a substantial amount of time, given that Nova Scotia's target for reduction needs to be met by 2030.

I strongly urge Council to focus on the larger picture of reducing carbon emissions and objectively judge the impact of wind farm development. The support for wind projects is strong within the Dalhousie community. We have numerous student societies, as well as research labs that are passionately devoted to the promotion of clean energy within Nova Scotia. I sincerely hope that wind energy adaptation receives renewed support and priority from our elected officials in Cumberland County.

Sincerely,

A Concerned Dalhousie Graduate Student

Nova Scotia Needs Wind!

Hello,

Climate change is real and so is our need to address it with real solutions. As a proud Nova Scotian, I'm encouraged that our province has committed to reducing our greenhouse gas emissions by more than half by 2030.

To get us there, the government is committed to 80% of electricity generation in Nova Scotia to come from renewable resources. This commitment requires citizens and elected officials to stand behind low-cost wind energy projects which will displace carbon fuels and bring Nova Scotia the cleaner environment and future that we need.

I understand the County is currently reviewing wind turbine regulations in the County's land use bylaw. I strongly encourage the County to develop regulations that are supportive of wind energy development. I would not want to see the roadblocks put up that discourage good projects from being built.

Given its windy location on managed forest land with existing transmission lines and roads, I feel the Higgins Mountain Wind Farm is proposed in a great location. The developer has consulted extensively with the community, incorporated feedback, and implemented real change in scale and turbine placement to minimize visual and sound impacts.

The developer has promised significant financial support for the local economy via a community benefits fund, as well as contracting and employment opportunities for local people and businesses. This is in addition to over $20 million in tax revenues estimated over the life of the project.

I strongly encourage the County to develop regulations that provide the certainty and predictability necessary to attract good wind projects, while protecting citizens nearby with reasonable setbacks.

Thank you for listening to my thoughts on this important matter.

Sincerely,

_____