Planning Fact Sheet

Land Use Bylaw: 22-2
Planning & Development Department
Date: March 2022

BEST PRACTICES FOR WIND TURBINE DEVELOPMENT

Forward

The purpose of this review is to identify and understand the policy components that make up effective wind turbine regulations. Defining these best practices provides a foundation from which to identify deficiencies in current planning policy. New policies and regulations informed by these practices can then be developed to remedy such policy gaps.

The information provided in this fact sheet is based on recent reports on wind development from around the globe. Note that regulatory mechanisms vary greatly between countries, especially the level of government responsible for approval or administration. A list of sources is provided at the end for further reading. While this report does not represent an exhaustive study of best practices, it does offer guidance for how wind projects can be responsibly developed in Cumberland.

Best practices for responsible and appropriate wind projects can be divided into the following categories.

- Effective stakeholder engagement at all stages
- Sharing the benefits of wind projects within the community
- Effective siting of wind projects
- Appropriate regulatory requirements
- Wind facility operations and maintenance
- Decommissioning and reclamation

If these best practices are followed, the benefits of wind energy will be maximized while concerns and negative impacts will be minimized. Wind projects will be more likely to be accepted by stakeholders and benefit both the local and broader community.

Stakeholder Engagement

Stakeholder engagement is critical to gaining local support for wind projects. It establishes lines of communication between developers and stakeholders where concerns may be expressed, and questions answered. Communication can reduce confusion or misconceptions and helps developers receive input in the project ensuring it benefits the community and mitigates negative impacts. There are also intangible aspects to good stakeholder engagement. The process must be built on honesty, transparency, and open dialogue on all sides. This fosters mutual trust between the developer and stakeholders and ideally forms a good working relationship that allows each party to resolve conflicts.

Involving the public early through genuine engagement rather than simply following prescribed steps helps build support for wind projects. Moreover, this collaborative engagement process will more likely result in a proposal accepted by the community rather than making decisions in isolation and then defending them.

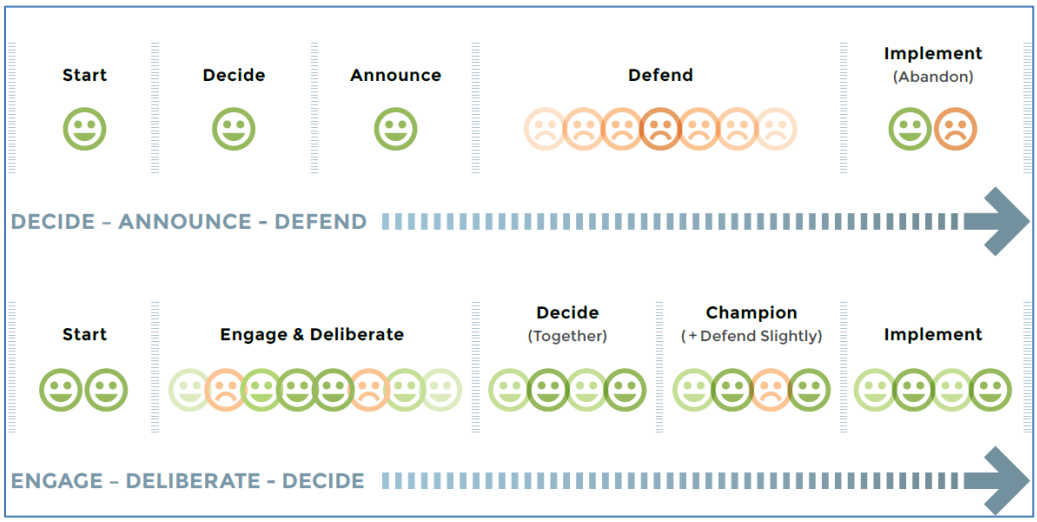


Figure 1 Collaboration vs Announce and Defend

Municipal planning tools can promote early community engagement in wind energy projects by requiring developers notify the Municipality before test towers are installed. This ensures that Council, staff and residents are aware of a proposed project early on. Informally, municipal leaders or staff can advise project developers, on appropriate ways to engage the community.

There is no one "right" way to engage a community; the approach will be as individual as the municipality and wind project. Elected officials and municipal staff are the experts on the dynamics of their community. However, there are best practices for community engagement specific to wind energy development.

In Nova Scotia there is an additional requirement to engage first nations communities. The Mi'kmaq of Nova Scotia must be consulted on proposed wind energy projects. The nearest Mi'kmaq Band Council should be contacted, as well as the Mi'kmaq Rights Initiative. The Mi'kmaq claim title and right to hunt, fish and harvest in all traditional uses of land in Nova Scotia.

Best practices for community engagement

- Start early and provide meaningful opportunity to impact the project.
- Understand the audience. Recognize the unique characteristics of the community and make concerted efforts to demonstrate your knowledge of, and respect for, the community in which you plan to develop a wind energy project.
- Encourage questions and answer in a direct and timely manner. Otherwise, initial interest may turn to negativity and opposition.
- Listen to concerns of the public and stakeholders. Then demonstrate your understanding and how you have given them consideration in the design and development of wind energy project.
- Handle negativity and opposition respectfully. It is important that the perspectives of those expressing concerns be understood. It is essential to show respect at all times and to share information in a professional manner.
- Public engagement should not stop once permits are issued. Community and other stakeholder consultation should continue throughout the life of the wind farm until it is decommissioned.

Shared Benefits of Wind Projects

It's human nature that those who stand to gain from an endeavour are more inclined to view it favourably and wind turbines are no exception. In Nova Scotia, wind project developers commonly lease land from local landowners and Municipalities receive taxes based on the rated power output of the turbines. The broader community however often bears the negative impacts without enjoying the economic benefits.

Some wind developers voluntarily contribute money back into the local community by means of a community endowment or benefit fund. Typically, this provides funds for a variety of local charities and community activities with the funds being managed by a community committee. While such community benefits seem to have been used successfully in other wind projects like South-Canoe, near Windsor, Nova Scotia (southcanoewind.com/Community.aspx) they are at the discretion of the developer. While one proponent has discussed such a fund, none have been utilised in Cumberland to date.

Until 2016 Nova Scotia's Community Feed-in Tariff (COMFIT) program encouraged community-based renewable energy projects by guaranteeing a rate per kilowatt-hour for the energy that feeds into the province's distribution electrical grid. The program was designed to broaden ownership of renewable electricity and facilitate community investment in electricity projects. Through COMFIT smaller producers were able to supply renewable energy to their communities and receive direct financial benefits.

Another growing financial model is through direct local investment. In Denmark, 20% of share values must be offered for purchase by landowners within 4.5 km of a wind project. Variations of this have been used in many locations including South Dakota, and the UK where a shared ownership taskforce has asked new wind turbine applicants to sell between 5% and 25% interest in their business to locals.

Traditionally, wind companies make lease payments to landowners who have wind turbines or infrastructure on their property. However, this means that neighbouring landowners do not receive lease payments but still experience the visual impacts from the turbine.

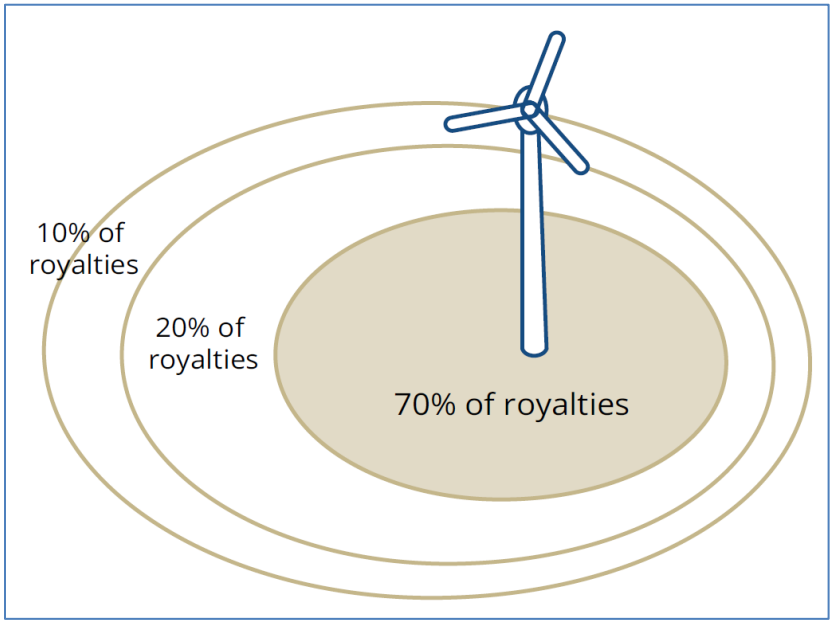


Figure 2: Pooled lease system

In a pooled lease model, neighbouring landowners receive a portion of lease payments based on the amount and location of their land in the pool. This provides transparency to landowners and can increase the sense of fairness by distributing benefits wider in the community. Such a system was used successfully in Halkirk, Alberta where landowners as far as 2 km away received lease payments as part of the pooled payment system.

Best practices for sharing the economic benefits of wind projects

- Offer to sell shares in the project to the local community.
- Provide funding back to the local community. Treat the local community like a local landowner and ensure that they receive a tangible benefit from having turbines located in their community.
- A pooled lease system can lead to broader acceptance by sharing benefits with more people.
- The Municipality can also dedicate a portion of tax revenue to benefit the local community.

Effective Siting of Wind Projects

Wind projects raise a wide variety of siting issues. Placing turbines to take advantage of the best wind resources must be balanced with minimizing their impact on existing land uses, neighbours, important viewsheds and the environment. Site selection generally begins using a range of desktop activities. Usually this involves studies on the technical, environmental, statutory planning, and community aspects of the site. Based on this assessment the proponent should be able to determine whether a site is suitable for further investigation and what further activities and investigation may be required.

Technical constraints on siting wind turbines include:

- The potential wind resource in the area.
- Cost effective electrical connection access.
- Suitable land ownership.
- Site access

Where wind turbines have such a prominent visual impact it is important to understand how they fit in the overall landscape including both the sensitivity and the value of that landscape. A comprehensive landscape assessment describes the landscape and evaluates its capacity for change in relation to the visual impact of the proposed development. Visual amenity must be considered in the context of the existing environment and with an appreciation of local community values.

The United States Forest Service (USFS) has developed a visual management system (VMS) to protect valuable landscapes which includes requirements for consideration, treatment, and protection of scenery and aesthetics. USFS is required to inventory and manage visual resources on USFS lands, and to assess the aesthetic impacts of timber sales and other activities. The visual management system developed by the UFFS has been used successfully as a framework for understanding the visual impact of wind turbines. An excellent example of such a visual assessment conducted for a wind farm was at Mt Fyans, near Melbourne Australia found here: http://surl.li/bphsy and also included in the sources.

Level of Visual Impact VL = Very Low, L = Low, M = Moderate, H = High		Viewer Sensitivity		
		H	M	L
Level of Visual Prominence	H	H	H	M
	M	H	M	L
	L	M	L	L
	VL	L	VL	VL

Figure 3: Visual Impact Matrix

Such an assessment can appraise the value of the landscape, the viewer sensitivity, the visual prominence, and the relationship to the broader viewshed. The visual impact resulting from the combination of varying levels of visual prominence and viewer sensitivity is illustrated in *Figure 3* in the visual impact matrix. This assessment process can be used to improve siting decisions and protect valuable and sensitive viewsheds.

At larger, global, and regional scales, the net effect of wind energy on the environment is generally considered to be positive, given that it will displace mining activities, air pollution, greenhouse gas emissions, and other forms of environmental degradation associated with non-renewable energy production. However, wind energy development is not entirely environmentally benign as it may cause localized environmental impacts including the loss or fragmentation of wildlife habitat and bird and bat collisions. Typically, regulations related to habitat and wildlife impacts are covered by provincial/state or federal regulations.

Environmental impediments that could prevent development at the site might include such factors as:

- Rare species or migratory routes
- Environmentally sensitive areas
- Water supply/ recharge areas

Best practices for siting wind projects

- Do your homework before investing in an area
- Be willing to accommodate.
- Consider cumulative impacts for larger projects
- Account for visual impact especially for larger projects
- Account for importance of sensitive landscapes

Appropriate Regulatory Requirements

Like any development, there are a wide variety of public concerns with wind energy. Appropriate and effective regulatory requirements strive to mitigate or even eliminate such concerns. As mentioned earlier, which aspects of development are regulated by various levels of government vary greatly between countries, states, or provinces. In Canada and many other countries, federal agencies regulate such matters as airspace, interference with radio transmissions, radar, and military installations. Many state/provincial jurisdictions also have environmental approval requirements once projects reach a certain size.

Planning ordinances or bylaws are the typical regulatory mechanism for local governments. Such ordinances or bylaws reflect local attitudes and concerns and are approved either by planning staff or elected officials. Because regulations can vary widely between jurisdictions this creates a patchwork of rules that can be confusing for both citizens and developers alike.

Land Use planning regulations related to wind turbine development normally include controls in the following areas:

- Where turbines can be located (zoning or restrictive overlays)
- Setback or separation distances from dwellings, roads, watercourses.
- Noise thresholds at set distances or nearby dwellings.
- Shadow-flicker or glint limitations
- Decommissioning requirements

Zoning for wind turbines can be permissive or restrictive and occasionally both. Cumberland, like many jurisdictions uses a restrictive overlay in addition to other limitations to exclude wind turbines from certain areas. Some jurisdictions have created zones where wind turbines have a less restrictive and often faster approval process. To support wind investment, policymakers can consider identification of Wind Energy Areas or Competitive Renewable Energy Zones (CREZ). Under this approach, the approval authority, in cooperation with various stakeholders, identify areas with significant wind resources and conduct initial evaluations to support wind development. In essence they follow many of the steps required for approval at an initial phase making subsequent approvals more expedient. This benefits both the local community and the wind energy sector by ensuring turbines are sited appropriately while creating a more streamlined and predictable approval process.

Such CREZ's have been used successfully in many jurisdictions including Denmark which issued a wind power planning directive with regional planning guidelines that designated appropriate locations for wind energy development for regional and municipal authorities. Local governments planning wind energy development could then use the regional planning guidelines to inform development and permitting processes.

Germany also designated a special status for wind turbines. This special status allows non-urban wind turbines that do not infringe on the public interest to easily receive a construction permit. As with the CREZ approach noted above, the government has identified suitable areas for wind development to support both local authorities and private investment.

Setbacks: The regulated setback distances for wind turbines can be very important in addressing issues related to visual impacts, shadow flicker, and noise. These distances can vary by jurisdiction but must

provide enough distance to avoid any safety concerns while also not being too stringent to prevent wind development altogether.

Jurisdictions vary markedly with setback requirements. Many countries have no specific setback requirement but commonly use noise thresholds as the limiting distance. Often setbacks will vary within a country depending on the local jurisdiction. Where specific setback requirements occur, they can vary wildly from 200m in Italy to 1000m in parts of Norway, Sweden and Western Australia with most not exceeding 550m. Some jurisdictions have setbacks as a function of turbine height, rotor diameter or mast height such as Denmark which uses 4x the turbine height from dwellings and Netherlands which uses 4x the hub height.

Noise: It is important to mitigate noise impacts from wind turbines, including audible sound, low-frequency sound, and vibrations. Noise emissions increase with increasing wind speed for wind turbines; therefore, the increase in noise from turbines is normally accompanied by an increase in the background noise. A large component of this additional background noise is generated from wind blowing past or through objects, such as trees or buildings. As a result, the background noise near a dwelling may be high enough to mask the sound of the wind turbines. This is why noise limits often include reference to background noise levels, and baseline limit (such as 40 dB(A) or 5 dB(A) above background noise). The (A) in dB(A) indicating that the readings have been weighted to account for how the human ear perceives varying frequencies differently.

Some noise standards also limit low-frequency noise (within 10 to 160 Hz) to 20 dB. Infrasound, the lowest-frequency noise (below 20 Hz) has been a concern in Denmark, but modern turbines are considered to produce very low levels of infrasound.

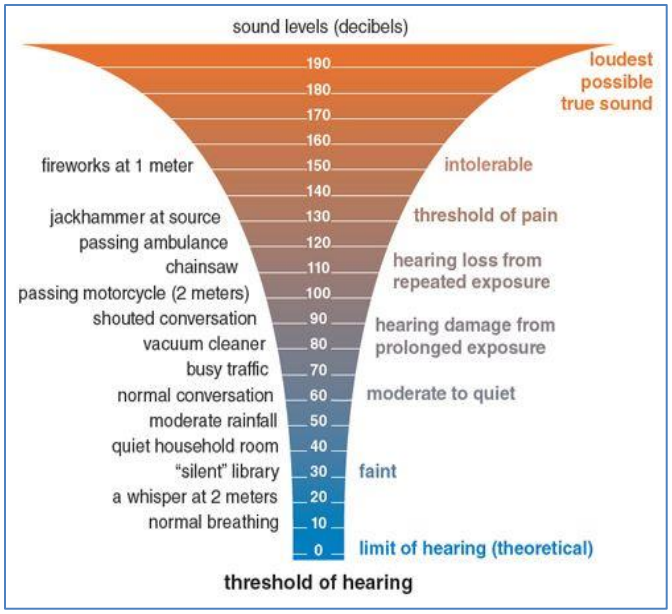


Figure 4: Comparison of common noise sources

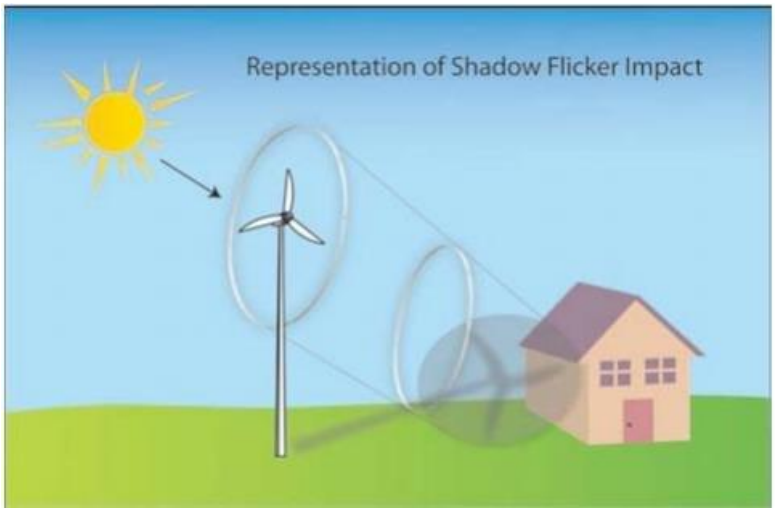
In Alberta, the permissible sound levels at dwellings during summertime conditions are 40 decibels at night and 50 dBA during the day, both on an equivalent continuous sound level. Similarly, Denmark sets the maximum noise levels for dwellings at various levels that depend on wind speed (e.g. 44 dB at 8 m/s or 42 dB at 6 m/s). More stringent requirements are set for sensitive areas (as defined in municipal plans). Other countries vary depending on the area with some regions limiting noise to as low as 35 dB while 40 to 55 dB is more typical. Some also regulate a threshold of 5 dB above background noise as noted above.

The general practice for allowable noise levels in residential areas for wind turbines is somewhere between 40 and 50 dB. Figure 4 illustrates the noise level of common sources.

A 2018 Noise Guideline report by the World Health Organisation recommends:
"For average noise exposure, [the Guideline Development Group] conditionally recommends reducing noise levels produced by wind turbines below 45 dB Lden, as wind turbine noise above this level is associated with adverse health effects." (Lden being a day-evening-night-weighted sound pressure level).

Nova Scotia's Environmental Assessment process requires that "*a 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 (dwellings, schools etc.)*

Shadow flicker: Shadow flicker occurs when the sun is low and casts a moving shadow on a location. As a result, shadow flicker is predictable and can sometimes be mitigated with tree or bush plantings, or suspended turbine operation. Some municipalities have set shadow flicker thresholds using the duration of shadow flicker that affects a certain location. Such regulators often cite a German standard of 30 hours of annual shadow flicker.



Nova Scotia's Environmental Assessment process requires 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."*

Figure 5: Turbine shadow on building

Best practices for regulatory requirements

- Regulations that are current and up to date. Technological changes and industry growth mean that regulations created a decade or more ago may no longer be appropriate.
- Balanced: regulations should encourage responsible wind development while mitigating the environmental and socio-economic impacts.
- Predictable Due-Process. All stakeholders whether proponents, landowners or members of the community should know what to expect and have faith in the process.
- Targeted. Its impossible to regulate every aspect of most developments. It is important then to ensure that the right requirements are in place and that the regulations are not unnecessarily arduous.
- Timely. Similarly, regulations and associated approval processes shouldn't be so long that the process creates unnecessary delays.
- Setback and noise requirements should be adequate without being prohibitive.
- Special zoning where the impacts of turbine has already been considered along with adequate public engagement can promote wind energy with fewer negative repercussions. Approval process in such areas can often be much shorter.

Wind Facility Operations and Maintenance

Ongoing operations and maintenance must be given due consideration. With an expected lifespan of 25 plus years, this is the longest stage of any wind energy project. With such long operating periods its critical that wind turbines operate in a way that minimizes negative impacts.

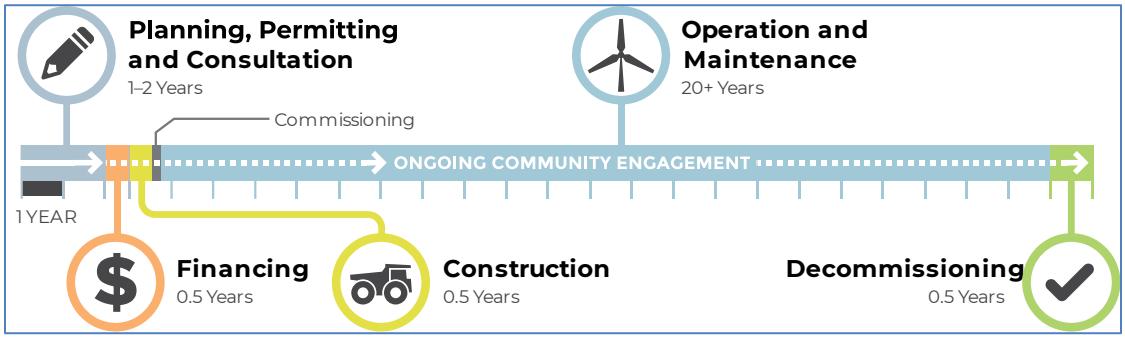


Figure 6: Stages of a wind energy project

Developers may be required to perform a variety of post-construction compliance testing and monitoring to verify regulatory compliance. Post-construction compliance testing should show the turbine to be compliant with the applicable limits as specified in the project's development approval. Instances of post-construction non-compliance should be immediately addressed and rectified.

An Environmental Management Plan (EMP) may be an approval requirement along with corresponding environmental protection, monitoring, and contingency plans. It is a common requirement of approval authorities that the environmental performance of the wind farm is documented in a periodic environmental report. Such environmental monitoring typically includes the following elements:

- Noise: Post construction measurements to confirm compliance plus complaint documentation.
- Shadow Flicker: Typically, documented complaints.
- Bird and Bat Mortality: Monitoring near turbines for carcasses.
- Aesthetics & Visual Impacts: Compare with predicted impacts plus recorded comments or complaints.
- Electromagnetic Interference: A complaint resolution system to record and investigate complaints regarding telecommunications interference.

Australia's Clean Energy Council recommends the following for Environmental Management Plans (EMPs):

EMPs will identify risks and/or significant environmental aspects, actions to be taken including mitigation, performance targets and monitoring processes and the establishment of offsets (where appropriate), during the operation of the wind farm. Dependent upon the conditions of the permit, if the performance of the wind farm triggers a specific threshold, there may be significant operational responses or other mitigation measures required to be implemented to ensure compliance of the wind farm. For example, if it was found that the noise levels measured at a relevant receiver were higher than those permitted, then measures would need to be put in-place to ensure noise emissions were lowered to permitted levels.

It would seem obvious then that sometime in the first few years that the results of an EMP and other post-construction testing and experiences be reported back to approval bodies and the general public.

Best practices for wind facility operations and maintenance

- Post construction monitoring. Provide continued monitoring of noise, shadow flicker, bird/bat kills and other environmental impacts.
- Documented Complaint Process. Residents near turbines should have access to a complaint resolution program. Such complaints and resulting actions should be documented and available to the public.
- Continued stakeholder communication and engagement. The developer should provide a community liaison program to provide regular updates to the community and stakeholders.
- Reporting. Approval authorities should receive a post-construction report along with regular reports on the status of the project and any issues.

Decommissioning and Reclamation

Concerns about decommissioning wind turbines have been raised in Cumberland and many other areas. Such concerns may be based by observing former mine sites, industrial facilities and gas stations abandoned or not properly decommissioned. Decommissioning plans should be developed during the planning stage and implemented at the end of the useful life of a project's wind turbines and associated infrastructure. While it is possible that wind turbines suffer the same fate, there are also some important differences.

Wind is a renewable power source and sites have the potential to continue generating revenue at the end of their service life. It is reasonable then to expect many to be replaced rather than decommissioned and reclaimed. Furthermore, if a wind company becomes insolvent, the project and leases would likely be purchased by another developer because of the potential long-term revenue stream.

However, this does not mean that a wind project would never need to be reclaimed. Some jurisdictions such as Montana and Massachusetts have adopted regulations to protect citizens from bearing the cost of reclamation from wind projects. In 2017, Montana passed legislation that requires that project developers include a plan for decommissioning and reclamation as well as post a bond to pay for eventual decommissioning. Many jurisdictions like Cumberland, have requirements for the removal of inoperable wind turbines by the owner or operator.

In 2016, *Texas Law Review*, drew attention to possible risks of Wind Energy developers using shell companies to shield themselves from liability for decommissioning wind turbines.

On July 21, 2015, British Member of Parliament David Davis stood up in the House of Commons and leveled a startling allegation against Britain's wind companies. These companies, Mr. Davis said, were organizing themselves in a way that rendered them judgment proof against the costs of decommissioning their generation facilities and against nuisance claims brought by neighbors. This could allow wind farms to be abandoned at the end of their operational lifespan, creating "visual blight . . . in perpetuity."

The problem that Mr. Davis identified was the use of shell companies— where a large parent creates a subsidiary to set up and control the operations of a specific wind farm. The problem with these subsidiaries, Mr. Davis said, is that they are marginally capitalized and often owe a large loan to the parent company. This "makes it impossible to bring litigation against a wind farm, simply because there is nothing to win from them."

If an operator decides that a wind farm will not be refurbished at the end of its operational life or will permanently cease operations, the site must be decommissioned. It is the responsibility of the owner of the wind farm to decommission the site. While the decommissioning is likely to be undertaken 20 years or more after the construction of the wind farm, it should be considered during the project development phase with the development of a detailed decommissioning plan.

Some jurisdictions require developers to put forward a surety of 125 to 150 percent of the cost of removal determined at the time of the granting of the permit. Some jurisdictions will allow a conservative estimate of salvage value to be used as a portion of meeting the surety. The estimated cost of removal should be determined by qualified engineer.

Best Practices for Decommissioning and Reclamation

- Developers should provide for future site decommissioning and reclamation. Decommissioning plans should outline the expected end of the project life, explain when and under what circumstances decommissioning and reclamation would occur, and include a proposed schedule for decommissioning.

- Plans should describe how the project will be decommissioned and outline the procedures for equipment dismantling and demolition, site restoration, and material recycling or disposal. This plan should include removal methods, procedures for disposal of the turbines, and measures necessary to prevent discharge of pollutants. The decommissioning plan should include site reclamation and a re-vegetation plan.

- Decommissioning plans should contain the estimated decommissioning costs net of salvage value in current dollars, and how the plan will be secured (e.g., bonds, contract). To ensure adequate funds are available to cover costs when the time comes, the permitting agency may require a bond or financial assurances from the developer to ensure that decommissioning costs do not become the responsibility of the local community or landowners.

Sources

Although not a definitive list, these documents were the primary sources used in this information sheet.

A Guide to Drafting Wind Turbine Regulations, Manomet Center for Conservation Sciences, 2013 https://www.manomet.org/wp-content/uploads/old-files/GuideToDraftingWindTurbineRegulations_Manomet_September2013.pdf

Best Practice Guidelines: For Implementation of Wind Energy Projects in Australia, Clean Energy Council, 2018 https://assets.cleanenergycouncil.org.au/documents/advocacy-initiatives/community-engagement/wind-best-practice-implementation-guidelines.pdf

Best Practices for Sustainable Wind Energy Development in the Great Lakes Region, Great Lakes Wind Collaborative, 2011 https://www.glc.org/wp-content/uploads/2016/10/2011-wind-bp-toolkit.pdf

Environmental Noise Guidelines for the European Region, World Health Organization, 2018 https://www.euro.who.int/__data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf

Land-Based Wind Energy Siting- A Foundational and Technical Resource, US Dept of Energy, 2021 https://www.nrel.gov/docs/fy21osti/78591.pdf

Mt Fyans Wind Farm: Preliminary Landscape and Visual Assessment, URBIS, 2016 https://www.planning.vic.gov.au/__data/assets/pdf_file/0022/106951/Attachment-E-Preliminary-Landscape-and-Visual-Assessment.pdf

Policies to Support Wind Power Deployment- Key Considerations and Good Practices, Clean Energy Solutions Centre, 2015 http://www.nrel.gov/docs/fy15osti/64177.pdf

Solar and Wind Energy In Canada-Value Recovery and End of Life Considerations, Smart Prosperity Institute, 2021 https://institute.smartprosperity.ca/sites/default/files/Policy%20Brief%20-%202021%20-%20Solar%20Wind%20-%20October20.pdf

When the Wind is fair: Best practices for responsible wind development in Alberta, Pembina Institute, 2017 https://www.pembina.org/reports/wind-best-practices-report-final.pdf

*Wind Energy's Dirty Word: Decommissioning**, Texas Law Review, Volume 95 - Issue 1, 2016 https://texaslawreview.org/wp-content/uploads/2016/12/Stripling95.pdf

Wind Energy Fact Sheets for Nova Scotian Municipalities, Union of Nova Scotia Municipalities, 2015 https://static1.squarespace.com/static/5c7584a9e666695f7a4ab7d7/t/5cf539cef8ea0400015c7d28/1559574996847/Wind+Energy+Fact+Sheets+for+Nova+Scotian+Municipalities.pdf