SMALL WIND SITING AND ZONING STUDY

DEVELOPMENT OF SITING GUIDELINES AND A MODEL ZONING BY-LAW FOR SMALL WIND TURBINES (UNDER 300 KW)

developed for the
Canadian Wind Energy Association

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Executive Summary

The Small Wind Committee of the Canadian Wind Energy Association (CanWEA) commissioned this study to: a) provide local government officials with the tools and resources they need to address Canada's growing interest in on-site wind power generation; and, b) provide owners and retailers with "Best Practice" guidance for the installation of small wind turbines. This study draws on numerous interviews with local planning officials and a survey of small wind retailers to analyze the current treatment of small wind turbines and provide "Best Practice" siting guidelines, a model municipal zoning by-law, and recommendations for CanWEA.

The study team found that many local governments are in the process of updating or revising their small wind planning and permitting protocols. Both the "Best Practices" and model zoning by-law cover the full range of issues related to zoning plans and siting requirements for small wind turbines: wind resource assessment, height restrictions, setbacks, sound, safety, fire risk, neighbouring property value impacts, visual considerations, and insurance requirements. The study examines these key issues within the context of the varying characteristics of different types of small wind turbines, ranging from "mini" 400 Watt battery-charging off-grid systems to mid-sized 300 kW systems that feed electricity into the local utility grid.

The siting and permitting "Best Practices" provide practical guidance for turbine dealers, installers and prospective small turbine owners. These recommendations take into account the current treatment of small wind energy systems both in Canada and in the United States, and incorporate the experiences of Canadian small wind turbine retailers and installers, local permitting officials, and pioneering consumers.

Local governments can use this study as a basis for reviewing their existing regulations or in drafting new regulations. The Model Small Wind Turbine Zoning By-Law provides a solid starting point that can save planning staff valuable time, and can be adapted and fine-tuned to accommodate both existing regulations and emerging incentive programs across the country. The study concludes with steps CanWEA can take to encourage Canadian municipalities and regions to adopt this model by-law.

"Getting the word out" on these recommended siting guidelines and model zoning policies can take many forms, including making public presentations, developing case studies of successful installations, networking with local government associations, and tapping Canada's small wind industry to convene educational and demonstration workshops. Direct mail campaigns can also play a key role to target scarce resources in regions with the most promise.

As the small wind industry grows, it is in the interest of all stakeholders (local governments, Canadian citizens and the small wind industry) to ensure proper installation of these clean electricity generators. A key element of this strategy is to ensure that the planning and permitting of small wind turbines is affordable, streamlined, accountable and transparent. This study is designed to provide a basis for evaluating current procedures and protocols while also offering guidance on how to improve existing regulations and practices shaping Canada's small wind turbine market.

Introduction

Siting barriers have long plagued the wind industry, delaying installations, increasing costs, and frustrating customers. Many land use planners and municipal permitting officials are not familiar with wind energy – or they may be focused on commercial wind development issues and lack basic information about small wind turbines. They may not be prepared to field small wind siting questions from local residents or appropriately process permit applications. Consumers who embark on a small wind energy project without prior understanding of the permitting process may encounter a daunting array of siting considerations and confusing regulations; attempting to sort out inconsistent sources of information, they may sometimes make choices that later prove problematic.

While relatively few small wind turbines have been installed to date in Canada,[1] the market appears to be growing rapidly as more Canadians become interested in systems for both on-grid and off-grid applications. Over the next ten years it is expected that sales of small wind turbines will increase significantly nationwide, with notable growth in on-grid residential and farm applications. Provincial adoption of net metering policies, rising electricity costs and environmental concerns are driving this increased interest in new small wind applications. In the longer term, growth in the small wind market may be driven by more advanced programs such as Standard Offer Contracts (or "Advanced Renewable Tariffs") and customer rebates at provincial and/or federal levels.

This projected growth in the small wind turbine market offers significant challenges for planning and permitting officials to ensure that the siting of small wind turbines follows "best practices." The effective siting of a small wind turbine needs to account for a variety of factors, including the wind resources available at the specific site, safety considerations, and aesthetics. Inappropriate siting can generate conflicts between neighbours, municipal officials and small wind turbine owners. On a larger scale, these conflicts could create an environment hostile not only to the small wind market, but to large-scale wind development as well, since the public tends to associate the two technologies despite their significant differences.

This study consists of five sections. Section 1 sums up the current treatment of small wind turbines in Canada, relying upon interviews, surveys and other research to paint a picture of how small wind turbine applications fare in the current regulatory environment, the definition of "small wind," and how provincial and municipal government regulations impact these proposed electricity generators. Lessons learned from the U.S., where a few states have fairly mature planning and permitting systems in place, are also incorporated into this analysis. It is clear that at present, few, if any, Canadian municipalities, regions, provinces or other governmental structures possess an ideal package of policies governing small wind turbines.

Section 2 focuses on "Best Practices" for small wind owners and retailers, addressing such key small wind siting considerations as: site selection, tower height, sound, visual impact, property

[1] A recent study indicated that annual Canadian sales of turbines under 300 kW are in the range of about 600 to 800 units per year, with the vast majority of sales in turbines under 1 kW for battery-charging applications.

line setbacks, distance to dwellings, property values, and public safety considerations. Drawing on the experiences of small turbine installers, a survey of Canadian small wind turbine retailers, manufacturers, and other stakeholders, existing recommendations from the American Wind Energy Association and a review of guidelines used in several U.S. states, this section offers proposed guidelines on tower height, sound limits, visual impacts and setbacks. It also answers the most common questions on public safety.

Sections 3 and 4 distill these "best practice" guidelines into ready-to-use tools. Section 3 offers a step-by-step checklist for small turbine owners and retailers. Section 4 provides a Model Small Wind Turbine Zoning By-law for municipal and regional officials to use as a basis for developing local permitting language and application processes. It includes a recommended definition of "small wind," reasonable boundaries for local permitting fees, and model language for use in notifying neighbours.

Section 5 concludes the report with recommendations to help CanWEA transform this research into actual policy and purchase decisions shaping the market for small wind throughout Canada in the years to come. The Appendices are rich with reference materials. Numerous additional anecdotes are included from current Canadian local government officials discussing their experiences to date with siting wind turbines. A question-by-question tabulation of survey responses also is included, and a draft model neighbour notification letter is offered as a tool to help facilitate community acceptance of small wind technology.

1. Current Treatment of Small Wind

This section provides an overview of the current treatment of small wind in Canada from the perspective of siting and zoning. Specifically, the section covers:

- Definition of "small wind" and sub-categories of small wind turbines
- Terms used in siting and zoning
- Role of provincial and municipal governments with respect to siting and permitting of small wind
- Overview of the current municipal treatment of small wind
- Description of federal and provincial environmental assessment processes as they pertain to small wind
- Treatment of small wind by selected U.S. states and the American Wind Energy Association.

1.1 What is "Small Wind"?

One of the most basic questions is the definition of small wind turbines. Current practice varies widely across Canada. In response to a survey of Canadian small wind turbine retailers, manufacturers, and other stakeholders, most survey respondents agree that it is appropriate to classify wind turbines up to 1 kilowatt (kW) typically mounted on 11-20 m (35-65 ft) towers as "mini" or "micro", wind turbines from 1 to 30 kW typically mounted on 24-43 m (80-140 ft) towers as "small", and wind turbines from 30 to 300 kW typically mounted on 24-50 m (80-164 ft) towers as "medium" or "mid-sized". However, it was clear from the survey responses – and from a review of existing small wind by-laws – that local governments have no consistent definition of what constitutes a small wind energy system.

A common perception is that "small wind" refers only to "off-grid" systems in remote locations. While off-grid applications certainly form an important subset of small wind systems, several survey respondents argue that the determining factor should be whether the turbine owner intends to consume the power the system generates for personal (or "on-site") use, as opposed to generating power for resale. The term "on-site" may mean either "behind-the-meter"[2] (in the case of grid-connected sites) or "off-grid." As more jurisdictions begin to offer net metering,[3]

[2] Grid-connected installations can be set up either to use all power on site, supplementing on-site electrical use with grid power as needed, or to feed excess production on to the grid in a net metered arrangement. Different connection standards and electrical safety considerations affect each of the two options.

[3] Net metering is a simplified method of metering both the grid power consumed and the wind power produced by a customer-owned wind turbine or other renewable energy system, where electricity produced by the wind turbine in excess of the customer's needs at any given time is fed onto the electric grid. This excess wind generation either spins the customer's electricity meter backwards or is read from a second meter and balanced against the customer's outgoing meter. The electricity is effectively banked until the customer's demand for electricity exceeds on-site generation, providing the customer with full retail value for all the electricity produced. Currently four Canadian Provinces (PEI, Ontario, New Brunswick, Nova Scotia) have passed legislation to allow net metering. Individual utilities (including BC Hydro and Saskatchewan Power) in other provinces have introduced policies to allow net metering, but are not required to do so. For more information see www.smallwindenergy.ca/en/SmallWindAndYou/ConnectingToTheGrid/NetMetering.html and www.energy.gov.on.ca/index.cfm?fuseaction=renewable.netmetering.

demand for grid-connected small wind energy systems will continue to grow.

CanWEA recommends that small wind energy systems be defined as:

> *a wind energy conversion system consisting of a wind turbine, a tower, and associated control or conversion electronics, which has a rated capacity of not more than 300 kW, and which is intended to provide electrical power for use on-site (either behind the meter or off-grid) and is not intended or used to produce power for resale.*

1.2 DEFINITION OF TERMS

- **Tower height** – *the height above-grade of the fixed portion of the wind turbine tower, excluding the wind turbine and rotor.*
- **Total System Height** – *the height from ground level to the tip of the rotor at its highest point.*
- **Sound** – *generally is measured in dBA, or A-weighted decibels to compensate for the human ear's sensitivity over a range of frequencies. It is important to distinguish between* ***sound power level****, which is a measure of source strength, and* ***sound pressure level****, which is a measure of the sound level at a receptor (e.g., a neighbour's house).*
- **Visual impact** – *because turbines are mounted on tall towers, they often are visible from beyond the property line. The impact of a small turbine's visibility depends on the landscape setting, the points from which it would be viewed, and the attitudes of those whose views would be affected.*
- **Property line setback** – *the required minimum distance from the base of the tower to the nearest property line.*
- **Distance to dwellings** – *some jurisdictions set different requirements for dwellings than for non-habitable structures such as silos or storage sheds, requiring a different minimum distance between the turbine and dwellings located on the owner's property versus dwellings on neighbouring properties*
- **Public safety considerations** – *these include such factors as the structural integrity of the turbine tower and equipment, electrical safety requirements, air traffic safety, etc.*

1.3 ROLE OF PROVINCIAL AND MUNICIPAL GOVERNMENTS

Wind powered electricity generation is a relatively new endeavor in most areas of Canada. Provincial governments, including Ontario and PEI, have included language supportive of wind and other forms of renewable energy in their Planning Acts, but the provincial directives tend to be vague and not well-coordinated with past or existing local government planning policies and zoning by-laws. Municipal governments make nearly all siting decisions, and there is no standard approach for the treatment of small wind turbines.

In Canada zoning by-laws and permitting regulations are a function of local government, with a number of neighbouring small towns often comprising a regional municipality, consolidating municipal government functions such as planning and permitting. Rural areas that lack an Official Plan of their own often reference Planning Acts adopted by the provincial government.

Some Provincial Planning Acts, such as those of Ontario and PEI, include language supportive of wind and other forms of alternative energy without giving specific guidance as to how such projects are to be treated. PEI, for example, has a setback requirement for wind turbines, but it currently does not distinguish between large and small turbines.

Due to intense interest from commercial wind developers, representatives at the local levels of government have focused primarily on large-scale commercial wind farm development. Generally speaking, small-scale installations are not yet "on the radar screen" at the municipal level. Most government representatives lack a basic understanding of the definition of "small wind," defining it in some cases not by size or end use, but simply as "off-grid." However, as net metering policies are becoming more common in Canada, more small and mid-sized turbines are likely to be grid-connected.

1.4 Overview of Current Municipal Treatment of Small Wind

This study identified only a handful of Canadian municipalities with small wind provisions in their zoning by-laws, with widely inconsistent and often unduly restrictive regulations. The majority of governmental representatives interviewed for this study professed a lack of precise information about the specific procedures and policies surrounding the siting of the limited numbers of small wind turbines that have been installed in their jurisdictions to date. Broadly speaking, permitting of small-scale wind turbines generally falls into one of three following scenarios: *no zoning*, *zoning non-specific to wind*, and *wind-specific zoning*. A review of existing small wind regulations in Canada reveals that at present, few if any municipalities, regions, provinces or other government structures possess an ideal package of policies governing small wind turbines.

1.4.1 No Zoning

Absent local zoning regulations, potential wind turbine owners in rural or unincorporated areas typically need to obtain a building permit from the code enforcement officer in their local planning or municipal office. Building codes often include standard height restrictions, typically 10-12 m (33-39 ft). The municipality or region may reference the Provincial Planning Act, but with the exception of PEI, none of the provincial plans currently include provisions specific to siting wind turbines. Without zoning by-laws in place, a property owner's insurance carrier may determine the setbacks it considers appropriate in order to limit liability.

1.4.2 Zoning Non-Specific to Wind

The majority of municipalities in Canada have zoning by-laws but no official policies specific to wind. In this situation, standard building height restrictions, typically 10-12 m (33-39 ft) are the by-laws most likely to affect the siting of small wind turbines. Potential turbine owners may be successful in requesting amendments to provisions exempting specific uses (e.g., church spires, silos, water towers) from the height restriction to include small wind. In the case of Blue Mountains in Grey County, Ontario, a long-standing provision allowing water-pumping windmills to exceed the height restriction was the basis for granting a variance to a small wind turbine applicant.

1.4.3 Wind-Specific Zoning Rules

As interest in both commercial and on-site wind energy has increased, municipalities and regions have passed or begun to consider passing zoning ordinances specifically to regulate the siting of wind energy systems. Approximately 5% of Canadian municipalities address wind energy in some manner. Zoning laws geared to large-scale or commercial wind energy development and policies for all wind turbines regardless of size may not be appropriate for small-scale wind installations. Individual turbines expected to generate energy solely for on-site use may be exempt from by-laws or amendments designed to regulate commercial wind projects.

> "We are just at the stage of coming up with policy for all wind turbines in Grey County, regardless of size. The majority of municipalities have no official policies or zoning prohibitions against small wind turbines as long as the energy is used at an individual house. I believe all one has to do [to install a small wind turbine] is get a building permit."
> – *consulting planner for Grey County*

The City of Charlottetown was able to easily approve an application for a domestic waste collection and sorting facility to install a 50 kW wind turbine in one of the city's industrial parks last year. The City only chose to enforce two requirements above the PEI Provincial Planning Act setback rules for all sizes of wind turbines. At the request of a neighbouring business that was notified by letter of the impending installation, an ambient sound assessment at the property line was conducted to ensure that the wind turbine would not exceed existing levels for the area. In addition, a variance to the existing bylaw was required to allow a tower of over 10 m (35 ft) in height.

> "At this point, small wind turbines can be sited almost anywhere. There are certainly no prohibitions, as is the case with the large commercial wind farms."
> – *Grey County Planner*

Where small wind turbines are a specifically permitted use, the most common types of restrictions concern maximum height, setback requirements, sound levels, and blade clearance above grade. The by-laws reviewed for this study reveal wide variations among restrictions. For example, setback requirements mitigating potential safety as well as potential sound and visual impacts range from none to 4 times the height of the tower from the property line or other building structure on the same property. Wind-specific height restrictions range from 24.3 m to 121 m (79.7 to 397 ft), with the latter limit geared to commercial-scale turbines. At least one community has set a sound limit of 30 dBA (not much louder than a human whisper, which would be difficult to enforce) at the property line; others set the limit as high as 60 dBA.

The Town of Malahide, along the north shore of Lake Erie in Ontario, adopted regulations in March 2005 that limit small wind turbines as an accessory structure in agricultural zones. Small turbines fall under site plan review as part of the building permit approval process. Required setback from the property line or any other building structure is 1.2 times the height of the tower. A building inspector interviewed for this study was aware of only one small wind turbine that has been erected in Malahide – in an agricultural area far from neighbours where planners did not consider sound to be a concern. The only threshold requirements that the Town of Malahide imposed for the installation were setbacks and a structural engineering analysis of the tower.

The municipality of Meaford (population 11,000) has among the most permissive regulations on height restrictions, allowing towers to go as high as 60 m (200 ft). In contrast, the Town of Blue Mountains imposes a height restriction of 11 m (32 ft), a long-standing regulation originally devised for old-fashioned water pumping windmills. Similarly, the Tiny Township in Simcoe County limits turbines to 10 m (34 ft), requires a setback of 1.5 times the tower height, and allows only one turbine per property.

None of the Canadian local zoning ordinances reviewed for this study include policies regarding removal of non-operating machines. Many counties in the U.S. require owners of small wind turbines no longer working to take them down after a prescribed length of time, usually within at least two years.

1.5 Federal Notification and the Canadian Environmental Assessment Act

In January 2006 Transport Canada (TC) issued Advisory Circular CAR621.19 providing guidance on lighting wind turbines between 90 and 150 m (295 and 492 ft), including the length of the blade. However, even the largest "small" wind turbine currently offered in Canada, the 250 kW WES30 turbine, with a rotor diameter of 30 m (98 ft) and typically installed on 50 m towers (164 ft) for a total height of 65 m (213 ft), would not be subject to this new standard.

TC also requires that prospective turbine owners provide the agency with the accurate location (latitude and longitude) and height of all wind towers through the aeronautical clearance application process[4] so that the agency can plot the turbines on aeronautical maps and flight paths, which include shoreline areas. Navigation Canada may then impose specific markings and lightings that must appear on the turbines so that helicopters and airplanes in both commercial pathways and search and rescue zones will be able to visually identify the wind turbines. For

[4] http://www.tc.gc.ca/quebec/fr/aerodromes/aero_pdf/obstacle.pdf

turbines in flight paths, Nav Canada may require painting the blades "International Orange" and installing fail safe strobe lighting on the top of the turbine nacelles.

The Canadian Environmental Assessment Act (CEAA) requires the application of the federal environmental assessment (EA) process when a federal authority is involved in a project. This includes projects receiving Canadian government funding – including the Wind Power Production Incentive (WPPI)[5] – and projects proposed to be built or installed on public land. Provincial governments also may require environmental assessments, but in most cases, these are less stringent and small projects (such as small-scale turbines) may be exempted.

In November 2004, Parks Canada installed a 10 kW wind turbine to power a campground at PEI National Park. Part of a five-year rehabilitation program to improve the parks ecological integrity while reducing greenhouse gas emissions, the project was subject to a streamlined EA process to ensure minimal adverse impact on the environment during construction, operation, and rehabilitation phases. Parks Canada first needed to obtain an assessment of the area from the Canadian Wildlife Association to determine if any endangered species could be affected by a wind turbine installation. Secondly, Parks Canada had to hire an outside consultant to research and write a study on the level of expected bird and bat mortalities that could be attributed to the installation of the wind turbine. Once these requirements were satisfied, there were no further EA issues with the installation. The turbine was not to be sited in a protected area or Zone 1, but rather a Visitor Use Area or Zone 3 where regulations are not so stringent.

1.6 Treatment of Small Wind by Selected U.S. States and AWEA

A few states (including California, Wisconsin, Nevada, New York and Michigan) and numerous local jurisdictions in the U.S. have adopted zoning policies and model ordinances related to the siting of small wind energy facilities. As in Canada, many local U.S. jurisdictions have developed regulations in response to the growth of commercial-scale wind farming, resulting in ordinances that may not be appropriate for siting small-scale wind energy systems intended for on-site use. In some cases, local ordinances have evolved as communities have become more familiar with small-scale wind technology.

The American Wind Energy Association (AWEA) offers a national Small Wind Model Zoning Ordinance to help local officials design or update ordinances governing small wind turbine installations. AWEA and a broad stakeholder Advisory Committee recently developed an alternative model for use in residential towns in New York addressing concerns in more densely populated residential areas.

California adopted a landmark state law, Assembly Bill 1207, to promote small wind turbine installations by standardising permitting processes, establishing a default zoning ordinance and

[5] Provides approximately 1¢ per kWh for wind farms independently metered at the point of interconnection with the electricity grid with a minimum nameplate capacity of 500 kW. In northern and remote locations, the minimum capacity is 20 kW. To encourage regional participation, the program has set a minimum and maximum capacity for every province and territory, which will be reviewed on an ongoing basis. For more information see www.canren.gc.ca/programs/index.asp?CaId=107&PgId=622.

requiring local authorities to approve small wind turbine applications by right if specified conditions are met, with the following rationale:

> *Distributed small wind energy systems. . . enhance the reliability and power quality of the power grid, reduce peak power demands, increase in-state electricity generation, diversify the state's energy supply portfolio, and make the electricity supply market more competitive by promoting consumer choice.*

AB 1207 also supersedes specific restrictions contained in existing county ordinances that exceed allowed limits; the state law trumps local permitting rules unless they are less restrictive. Similarly, Wisconsin's State Statute 66.0401, limits the authority of local officials and prohibits any restrictions on the installation of wind energy systems that do not:

(a) Serve to preserve or protect public health or safety;
(b) Significantly increase the cost of the system or significantly decrease its efficiency; or
(c) Allow for an alternative system of comparable cost and efficiency.

Nevada recently passed a law that is very similar to Wisconsin's in protecting the rights of those wishing to install wind systems. Wisconsin and Michigan have also developed and are promoting statewide model zoning ordinances to assist local governments in amending their existing ordinances to address small wind energy systems (see Appendix B: Resources for weblinks).

The following table summarizes how selected jurisdictions in Canada and the U.S. treat small wind turbines. Additional information from interviews with planners is included in Appendix C.

1.7 Comparison of Selected Sample and Model Small Wind Turbine Zoning By-laws

Juridiction	Character	Turbine Density (max)	Lot Area (min)	Height (max)	Blade Clearance Above Grade	Setback (min)	Fencing	Signs	Sound	Removal	Communications
Meaford, ON	Small urban core, the rest rural	Not Specified	Not Specified	Approved up to 30 m, may approve as high as 45 m-60 m	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified
Clarington, ON - 1 Wind Turbine	Moderate downtown core, rest mostly rural	1/lot	0.4 ha	91.44 m	6 m	15 m to all property lines	Not Specified	Not Required	Not Specified	Avg lifespan of 25 yrs	Not Required
Town of The Blue Mountains, ON	Ski resort town with small core and some rural	Not Specified	Not Specified	Several structures exempt from 11 m height limit, incl. "windmills" - SWT variance granted	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified
Municipality of Grey Highlands, ON	Small urban core, rest rural/ag	Not Specified	Not Specified	Not Specified	Not Specified	In Southgate, visual impacts addressed with setbacks on case-by-case basis.	Not Specified	Not Specified	Not Specified	Not Specified	Not Specified
Malahide, ON	Small urban core, the rest rural	NA	NA	NA	NA	1.2 x height from any structure or boundary line	NA	NA	NA	NA	NA
PEI Canada Planning Act	NA	Not Specified	Not Specified	Not Specified	Not Specified	1x total height from property line, roads or right-of-way; 3x to nearest habitable bldg	Not Specified	single sign w/in 10' of grade	Not Specified	Not Specified	Not Specified

Juridiction	Character	Turbine Density (max)	Lot Area (min)*	Height (max)*	Blade Clearance Above Grade*	Setback (min)*	Fencing	Signs	Sound	Removal	Communications
California (US)	High density urban/suburban with rural and industrial zones	Not Specified	Not Specified	Allowable height at least 20 m for up to 0.4 ha, 25 m for up to 2 ha; varies by land use district	Not Specified	No farther than system height to nearest property line	Not Specified	Not Specified	60 dBA at closest neighboring inhabited dwelling; may be exceeded during short-term outages and severe storms	Not Specified	Allows requirement for providing notice to property owners within 91 m of turbine owner's property
Michigan - small wind (US)	Mix rural, suburban and urban	Not Specified	Not Specified	Not Specified	6.1 m	150% of height to top blade tip; 3 m for anchors	Not Specified	Not Specified	55 dBA	Not Specified	Not Specified
Wisconsin (US)	Mix rural, suburban and urban	Not Specified	Not Specified	52 m for systems up to 100 kW	Not Specified	Total height from property line, utility lines and roads	First 2.4 m of tower unclimbable	Not Allowed	Not Specified	Removal within 3 mo of being out of service for 12 months	Not Specified
Rockingham County, VA (US)	Several small urban centers, majority is rural	Not Specified	0.2 ha	25 m for up to 0.4 ha, no limit for larger areas, must show height is recommended by manufacturer	4.5 m above ground, 3 m above structures w/in 45 m	110% of total height to property line; 150% height from dwellings on adja. prop.; min 3 m from property line to anchors	1.8 m tall fence around tower or first 3.6 m of tower are unclimbable	Not Allowed	60 dBA at property line during normal operation	Removal in 6 mo if deemed unsafe; explanation req'd if non-operational for 12 consecutive months	Not Specified
Strafford, VT (US)	Rural	Not Specified	Not Specified	22.8 M (75')	Not Specified	Total height from property line	Not Specified	Not Allowed	"Operation not to result in unreasonable noise levels"	Removal within 2 years of cessation of operation	Not Specified
American Wind Energy Association	NA	Not Specified	0.2 ha	25 m for 0.2 to 0.4 ha; >0.4 ha no limit	Not Specified	Anchors not within 3.05 m of property line	Not Specified	Not Specified	60 dBA, at nearest neighboring inhabited dwelling	Not Specified	Recommended
AWEA-NY model	Mix urban, suburban and rural	Not Specified	0.2 ha	37 m for 0.4 - 1.2 ha; 60 m for 1.2 - 2 ha	Not Specified	Tower height, anchors must be min 3 m from property line	Not Required	Not Specified	6 dBA over background noise	Not Specified	Recommended

* all converted to metric for comparison

2. Best Practice Guidelines for Consumers and Installers

This section addresses key small wind siting considerations: site selection, tower height, sound, visual impact, property line setbacks, distance to dwellings, property values, and public safety considerations. The study team invited approximately 120 Canadian small wind turbine retailers, manufacturers, and other stakeholders to comment on these aspects of small wind siting, and a total of 29 responded, representing more than a 20% response rate.[6] In combination with existing recommendations from the American Wind Energy Association and a review of statewide guidelines for California, New York, Wisconsin, Nevada and Michigan, these survey responses informed the development of the "Best Practice" guidelines presented here and the Step-by-Step Checklist for Consumers in Section 3.

2.1 Appropriate Sites and Towers for Small Wind Turbines

Determining whether a site is physically appropriate for a small-scale wind energy system requires an assessment of the wind resource and the topography of the site. Such an assessment must take into account required setbacks from property lines and the proximity of other structures or natural features that might obstruct the wind or create turbulence. Farms and rural homes are typical candidates for on-site wind use; businesses and schools or other campus-based facilities may also prove suitable.

2.1.1 Assessing the Site

Recently updated wind maps allow a quick and easy assessment of wind patterns in the general area.[7] However, wind power on a particular site is greatly affected by nearby terrain. Obstructions may slow down wind, or features such as a hill, trough or valley may accelerate it. Experienced wind turbine dealers can often assess a potential site and recommend tower location and optimum height through visual inspection of trees and other vegetation. Those who want to confirm their resource may want to invest in monitoring equipment to measure wind speeds.

Within a site, the ideal turbine position is where wind is least obstructed – often but not necessarily the highest point on the site. At a minimum, it is best to elevate wind turbines into the laminar flow of the dominant wind direction in order to optimise productivity and reduce stress on mechanical components that reduces turbine life. Manufacturers always recommend elevating the turbine well above adjacent obstacles. A rule of thumb is that the bottom tips of the turbine blades should pass three times above the tallest upwind barrier or at least 8-9 m (25-30 ft) above any physical barriers (trees, buildings, bluffs) within 90-150 m (300-500 ft) of the wind turbine tower. One manufacturer suggests that clearance of at least 6 m (20 ft) may be adequate for light-weight "micro" turbines (under 1 kW). However, a site's terrain and wind resource, not turbine size, determines optimum wind turbine tower height.

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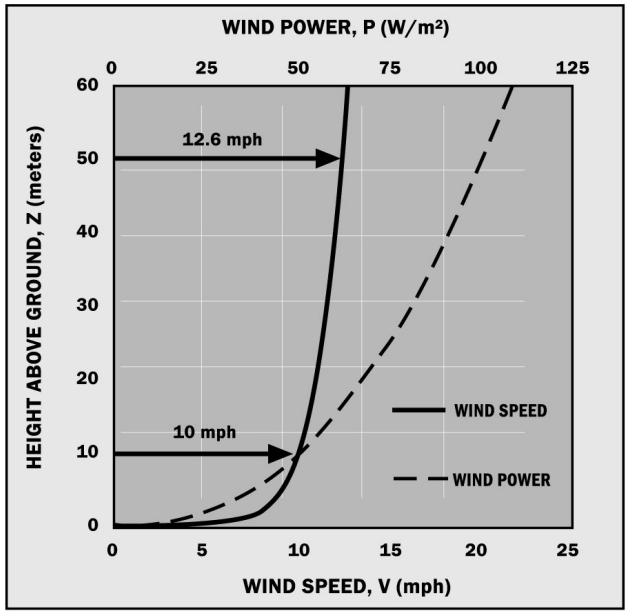
[6] See Appendix D for a tally of survey responses.

[7] See Appendix B for links to Canada's wind atlas and related information. CanWEA's small wind website (www.smallwindenergy.ca) provides a tool that estimates turbine output based on postal codes.

2.1.2 Tower Height

Wind speed increases with height, and gaining even a small increase in velocity boosts a turbine's generating potential significantly (see graphic). Some survey respondents feel that there should be no restriction on height, provided that engineering safety requirements are met and the tower can be accommodated within property lot lines. However, other survey respondents acknowledge that tower heights should be limited according to property dimensions, with setback considerations as well as general consideration for neighbours, sound, and visual impacts given as the reasons for such restrictions. In more remote or less populated areas, these considerations may not apply.



Typical Wind Shear Profile — Speed and power available in the wind increases with increasing elevation. The relationship is commonly referred to as the one seventh power law (a=1/7).

Courtesy Texas State Energy Conservation Office

2.2 Neighbourliness Considerations

2.2.1 Sound

Formal complaints are rarely filed against installed wind turbines. Small wind turbine dealers and installers acknowledge that turbines do make sounds, and that progress toward making quieter turbines is important. Most survey respondents indicated that the sound characteristics of the turbines they sell or install are satisfactory, and only one reported receiving complaints (from customers or others) about sounds coming from small wind turbines, in virtually every case related to turbines with flexible blades and side furling mechanisms. In most cases, the sounds wind turbines make when operating typically blend in with background sound from cars, animals, airplanes, and trees in windy conditions.

The first comprehensive sound test of small wind turbines[8] presented results for both the sound strength right at the wind turbine (sound power level) and at a specified distance from the turbine (sound pressure level). The sound power level varied from about 75-100 dB(A), which at a distance of 30 m (100 ft) from the rotor hub corresponds to sound pressure levels (perceived sound) of 40-65 dB(A). For comparison, 40 dBA is roughly equivalent to the sound level in an average living room; the average office is about 50 dBA, and a loud conversation is 60 dBA. In a typical quiet bedroom at night, the sound level might be 20-30 dBA. In some cases not much difference could be distinguished between turbine sound and background sound, and the test data overlapped. In a typical Class 3 wind regime with wind speeds averaging 5.6 m/s (12.5 mph), most commercially available small-scale wind turbines tested will produce sound pressure levels exceeding 65 dB(A) about 6% of the time, at wind speeds above 11 m/s (24 mph).

[8] http://www.nrel.gov/docs/fy04osti/34662.pdf

When responding to questions about sound, it is important to note that sound levels decrease at a rate equal to the square of the distance from the source. In addition, most sound from turbines under 10 kW is the result of blade flex and furling. A sound reading taken 7.6 m (25 ft) from a turbine will fall by a factor of four at 15 m (50 ft), by a factor of 16 at 30 m (100 ft), and so on.

2.2.2 Visual Impact

Because turbines must be mounted on tall towers to reach necessary wind conditions and avoid turbulence, visibility is unavoidable. Visibility does not, however, equate to visual impact. Many communities already accept water towers, silos, cell phone towers, and utility poles and lines as part of the landscape. Dealers and installers surveyed acknowledge that while there are many good reasons not to restrict small turbine installations on the basis of visual impact, there are situations in which visual impacts are considered, generally on a case-by-case basis. Ridgelines and other sites that are part of significant scenic or historic value may be sensitive enough to warrant restrictions. However, while it is appropriate to take into consideration sensitive viewscapes, turbines cannot always be positioned so as to avoid visibility. Many issues with respect to visibility can be addressed by consulting with neighbours beforehand. As discussed above, it is important to maintain a clearance of at least 8-9 m (25-30 ft) above trees or other natural or manmade structures that cause turbulence.

2.2.3 Recommended Setbacks and Distances to Dwellings

For the most part, respondents to the survey recommend property line setbacks based on the height of the turbine tower, in most cases equivalent to a single tower height. Specific suggested setback distances range from 6-9 m (20-30 ft) from the property line and two-thirds of tower height for "mini" turbines to 1.5 times the height of the tower up to 305 m (1,000 ft) from neighbouring residences for larger turbines. Some installers distinguish between habitable and non-habitable structures, with the latter not subject to setbacks. Some recommend that guyed towers should only be subject to setbacks from the base of the tower, as tethers and rock bolts should not be treated the same as the main foundation. For the most part, safety and liability considerations are the primary justifications that installers cite for setback recommendations. Sound and visual impacts are secondary considerations.

2.2.4 Property Values

There is no documented evidence that wind turbines – even commercially sized wind farms – have ever lowered the values of surrounding properties. In fact, a 2003 study conducted by the Renewable Energy Policy Project[9] examined 25,000 property transactions within 5 miles of 10 wind installations and found that values rose faster in those areas than in similar communities without turbines.

> "Our customers have sold their homes and adjacent lots, and they have had direct and nearby neighbours sell their homes. In all but one case the wind turbine was not an issue. In that case, the turbine had been partially installed on the abutting property due to a faulty survey. This situation was resolved amicably."
>
> *–U.S. small wind turbine manufacturer*

[9] www.REPP.org.

One U.S. manufacturer of small wind turbines confirmed that in over 25 years of business, he has never heard of a customer's wind turbine affecting the value of neighbouring real estate.

2.3 Public Safety and Related Considerations

Common questions regarding public safety include whether wind turbines may interfere with communications broadcasts and the operation of electronic devices, or pose a threat to utility line workers responding to power outages. In general, survey respondents feel that existing building and safety codes are adequate to address the installation of small wind energy turbines. Sound engineering design of both the wind turbine and its tower is, of course, a prerequisite for safe operation. Some of the wind turbine-specific issues are addressed below.

2.3.1 Interference

The rotors on small-scale turbines are not large enough to interfere with TV or communications signals, and their blades are made from materials that signals can pass through: e.g. wood, fiberglass, and plastic. Wind turbine generators also do not disrupt telecommunications or radio waves through electromagnetic interference. A representative of the National Renewable Energy Laboratory confirms that in 10 years researching small wind turbines, he has never encountered a problem with electromagnetic emissions, nor have other researchers found cause to study them. In fact, one of the major niche markets for small wind systems is powering remote telecommunications sites and military applications.[10]

2.3.2 Climbing Hazard

There is no need for wind turbine towers to be required to have greater access restrictions (e.g., special fencing or warning signs) than other similar poles and towers. Like other climbable structures, wind turbine towers can be equipped with devices that prevent falls. Some wind turbine tower models currently on the market lack hand- and foot-holds, discouraging trespassers. Some are designed not to be climbed, but to be lowered to the ground for maintenance and repairs.

2.3.3 Guyed Wires and Electrical Lines

Survey respondents strongly recommend that all guyed wires be marked up to at least 2 m and that electrical lines be buried from the base of the tower to whichever structure houses the balance-of-system components.

2.3.4 Line Worker Safety

National standards address the safety of the electrical equipment. All small wind equipment must adhere to, and be installed consistently with, local utility and safety requirements. In the 25 years that utilities have been required to interconnect small wind turbines to their grids in the U.S., no utility has filed a liability claim against a turbine owner over electrical safety. For an additional cost, systems can also be set up to run independently from the grid if the grid goes down. Wind systems that are not connected to the electric grid, though they pose no risk to line

[10] Mick Sagrillo, "Telecommunication Interference from Home Wind Systems" AWEA *Windletter*, Volume 22, Issue No. 4 April 2003.

worker safety, should be installed or at minimum inspected by a contractor qualified by the provincial or territorial electrical authority (e.g., the Electrical Safety Authority in Ontario).[11]

2.3.5 Insurance for Installers and Owners

All small wind systems should have property coverage in the event of damage due to weather, fire, or vandalism, as well as liability coverage for property and personal injury. One method of insuring the system is to add it to an existing homeowner's policy.[12] Some residential owners of small wind turbines have found it difficult or impossible to obtain homeowners insurance coverage at a reasonable cost. Commercial owners, such as farms, have had no reported problems with insurance. Prospective owners of wind turbines are encouraged to check with their insurance company prior to having the turbine installed.

2.3.6 Notification/Approvals Needed for Air Traffic Safety

Transport Canada requires that prospective owners accurately provide the location (latitude and longitude) and height of all wind turbines to be installed so that they can be plotted for aeronautical maps and flight paths. Navigation Canada may then impose specific markings and lighting that must appear on the turbines so that helicopters and airplanes in both commercial pathways and search and rescue zones will be able to visually identify the wind turbines.

[11] Electrical inspections may not be required for low voltage (12-48 V) off-grid wind turbines with stand-alone inverters and controllers certified by an accredited body such as CSA or UL. In Ontario, wind turbines not connected to home power systems at 120 V do not fall under the Ontario Electric Code. Wind systems can be installed "behind the meter" for specific applications without being connected to the house power supply, in essence "off grid" but supplementing a house's grid power.

[12] Sagrillo, M., Insuring your wind system, http://www.awea.org/faq/sagrillo/ms_insur1.html

3. Step-by-Step Checklist for Small Wind Customers

Step 1. Contact your planning department or permitting agency

- ❑ Are small wind energy systems specifically addressed in municipal by-laws? Are they considered a permitted or accessory use (subject to certain requirements)? Or, do they require a special use permit?
- ❑ Learn the relevant permitting procedures, including applicable forms and where to obtain them, notification or hearings required (if any), inspections, etc.
- ❑ What documents will you need? Will you need to submit plans from a consulting engineer, or will documentation from the turbine or tower manufacturer or dealer do?

Step 2. Review the applicable standards and restrictions

CanWEA recommends:

- ❑ Minimum parcel size: *0.1 ha (0.25 acre) for towers up to 25 m (80 ft); 0.2 ha (0.5 acre) for taller tower heights, typically wind turbines larger than 100 kW, subject to the setback requirements below.*
- ❑ Maximum tower height: *no limit other than where it cannot be accommodated within lot lines.*
- ❑ Setback: *From tower base, 1 tower height from property line and power lines*
- ❑ Sound levels: *mean sound pressure level value not to exceed 6 decibels (dBA) above background sound, as measured at exterior of closest neighbouring inhabited dwelling (for wind speeds >10 m/s).*
- ❑ Equipment: *approved by CanWEA-recognised small wind certification program (once in place).*
- ❑ Building code compliance: *manufacturer documentation of International Building Code compliance*
- ❑ Electric code compliance: *line drawing showing conformance with existing electrical codes and applicable authority (e.g. Electrical Safety Authority in Ontario).*
- ❑ Navigation Canada requirements: *Transport Canada must be notified of location (latitude/longitude) and height of all wind turbine installations; applicant must comply with any requirements.*

Step 3. Communicate with your neighbours

Local planners often advise applicants to notify their neighbours before proceeding with installing a wind turbine. Small wind turbine manufacturers also recommend early notification of neighbours. That courtesy will in many cases correct misperceptions and head off potential opposition. A simple letter can answer most questions neighbours have about a proposed small wind turbine, correct misperceptions and let your neighbours know you have properly researched the project. (See sample letter in Appendix E.)

Step 4. Plan your purchase and installation

- ❑ Customers are encouraged to get quotes from at least three installers.
- ❑ For grid-connected systems: *Notify electric utility and secure interconnection agreement (if required) in conformance with requirements established by local utility.*
- ❑ For off-grid systems: *Electrical components should be installed or inspected by a contractor qualified by the provincial or territorial electrical authority (e.g., the Electrical Safety Authority in Ontario).*

Step 5. Environmental review

- ❑ Projects located on public lands are subject to an Environmental Assessment (EA). Most small-scale wind turbines receive a negative declaration (no significant negative impact).

Step 6. Permitting fees and timetable

- ❑ Building permit and special use permit fees vary. *CanWEA recommends that fees not exceed $50.*
- ❑ If a particular fee seems excessive or inappropriate for your situation, find out the basis for the fee. You may be able to avoid it or have it reduced.
- ❑ The timetable for processing small wind turbine permit applications is typically up to 6 weeks from the time the permit and all required documentation are filed.

4. Model Zoning By-law

4.1 Recommendations for Local Governments

The study team has culled the following recommendations from an analysis of local permitting officials' experiences with small wind turbine installations, and through the experiences of pioneering consumers attempting to install wind generators.

Small wind systems may contribute such public benefits as reduced pressure on the local utility grid, increased local energy independence, and reduced dependence on polluting forms of electric generation. At the same time, because small wind systems are designed for on-site use rather than for commercial production and sale of electricity, it is more appropriate to treat them like improvements to an individual property than as commercial or industrial projects.

4.1.1 Defining "Small Wind"

As discussed in Section 1, CanWEA recommends that small wind energy systems be defined as:

> *a wind energy conversion system consisting of a wind turbine, a tower, and associated control or conversion electronics, which has a rated capacity of not more than 300 kW, and which is intended to provide electrical power for use on-site (either behind the meter or off-grid) and is not intended or used to produce power for resale.*

4.1.2 Zoning and Permitting Recommendations

Consider making small wind systems a permitted or accessory use.

- Classifying small-scale on-site wind energy systems as a permitted use or accessory use in all zoning classifications where structures of any type are allowed eliminates the need for public hearings while providing that specified requirements must be met.
- If it is not appropriate to classify all small-scale wind systems as permitted or accessory uses, consider creating a tiered application process that allows uncontroversial projects to proceed on a faster track.

Make permitting fees commensurate with non-commercial end-use.

- Generally speaking, fees should not exceed **two** percent of the original equipment cost of a small wind turbine. No extra fee should be assessed for installing controllers, inverters or batteries, which are no different than adding extra lights or circuits to an existing power panel.

Make sure height restrictions reflect the unique requirements of small-scale wind technology.

- While small-scale wind energy systems are a fraction of the size of utility-scale turbines, the lowest reach of the blades nevertheless should clear nearby structures and trees by a minimum of 8-10 m (25-30 ft) to avoid turbulence. To perform optimally, small-scale wind turbines typically are mounted on 24-50 m (80-164 ft) towers. Provided that the wind turbine tower, base and footings conform to national standards and do not exceed the height recommended by the system manufacturer, it is not necessary to restrict tower height.
- Likewise, setback requirements should take into account the fact that wind turbine towers are necessarily tall.

- Because of their height, small-scale wind turbines often are visible from beyond the property line. Visibility does not equate to visual impact, however, and it is not necessary to require that turbines always "blend in" with their environment. The need for visual impact mitigation measures should be assessed on a site-specific basis and be required only where there is a clear public benefit.

Establish reasonable standards for public safety.

- For wind turbine towers supported by guy wires, require the outer and innermost wires be clearly visible to a height of 2 m (6 ft) above the guy wire anchors.
- In most cases, turbines can be treated as any other climbable object (e.g., trees), and do not require fencing.
- Permit criteria should be sufficient to assure the public that the turbine is in compliance with public safety requirements.

Require permit applications to include documentation demonstrating the safety of electrical components and wind turbine tower.

- Require a single line drawing of the electrical components in sufficient detail to allow for a determination that the manner of installation conforms to electric codes if applicable. This is not necessary if local electric codes or utilities require separate inspection of electrical equipment outside zoning approval.
- Require standard drawings and an engineering analysis of the wind system's tower, base and footings and certification by a professional mechanical, structural, or civil engineer, but do not require a "wet stamp" – provided that the application demonstrates that the system is designed to meet or exceed the requirements of the International Building Code, or other locally-adopted code, appropriate for the installation location.

Encourage, but do not necessarily require notification of neighbours.

- A short letter to one's neighbours can answer most questions, avoiding misperceptions and letting neighbours know that the applicant has properly researched the installation.
- However, it is best to leave the process of whether and how to notify neighbours to the discretion of the wind turbine permit applicant (see sample letter in Appendix E).

Lighting requirements are costly and are generally unnecessary for towers under 90 m (295 ft)

- Navigation Canada may impose specific markings and lightings that must appear on the turbines so that helicopters and airplanes in both commercial pathways and search and rescue zones will be able to visually identify the wind turbines. However, unless required by Nav Canada, lighting requirements should not be locally imposed on small wind turbine towers.
- Lit towers are more attractive (and therefore more dangerous) to night migrating birds, especially during low-visibility weather conditions.

Any applicable sound restrictions need to take background sound and distance into account.

- To ensure enforceability, do not prohibit decibel levels from exceeding 6 decibels (dBA) above background sound as measured at the closest neighbouring inhabited dwelling.
- Allow sound limits to be exceeded during short-term events such as utility outages and severe windstorms.

The model by-law below provides a starting point that can save planning staff valuable time. It may need to be fine-tuned to accommodate existing regulations and emerging incentive programs.

4.2 PROPOSED CANWEA MODEL SMALL WIND TURBINE ZONING BY-LAW

Section 1. Intent and Purpose:

It is the purpose of this regulation to promote the safe, effective and efficient use of small wind energy systems installed to reduce the on-site consumption of utility-supplied electricity, while providing reasonable controls to protect public health and safety without significantly increasing the cost or decreasing the efficiency of a wind energy system.

The [City/Region] of _____ recognises that privately-owned small wind turbines are non-polluting, help reduce Canada's reliance on fossil fuels, help reduce public utility electrical demand and contribute to the efficiency of the utility grid.

The [City/Region] of _____ further recognises that small wind turbines are substantially different from commercial wind farms and from commercial cellular or radio towers as they are designed to supply electrical power for the owner and are not typically revenue-generating ventures. The much larger scale wind turbines and wind farms intended to sell energy directly to power companies or retail users are not covered by this Local Land Use Guideline and will be addressed independently.

This regulation requires the [City/Region] of _____ to approve an application for a small wind energy system by right if the criteria below are met, and authorises the local agency to charge a fee of not more than fifty dollars ($50) per small wind energy system. If any portion of the proposed small wind system does not meet the requirements set under this Local Land Use Guideline, a zoning variance will be required. No other local ordinance, policy, or regulation shall be the basis to deny the siting and operation of a small wind energy system.

Section 2. Findings:

The [Municipality] finds that wind energy is an abundant, renewable, and nonpolluting energy resource and that its conversion to electricity will reduce our dependence on nonrenewable energy resources and decrease the air and water pollution that results from the use of conventional energy sources. Distributed small wind energy systems will also enhance the reliability and power quality of the power grid, reduce peak power demands, and help diversify the local energy supply portfolio. Small wind systems also make the electricity supply market more competitive by promoting customer choice.

The [Province] of _____ has enacted a number of laws and programs to encourage the use of small-scale renewable energy systems including rebates, net metering, property tax exemptions, solar easements, and other incentives [as appropriate]. However, many existing local zoning ordinances contain restrictions, which while not intended to discourage the installation of small wind turbines, that can substantially increase the time and costs required to obtain necessary construction permits.

Therefore, we find that it is necessary to standardise and streamline the proper issuance of building permits for small wind energy systems so that this clean, renewable energy resource can be utilised in a cost-effective and timely manner.

Section 3. Definitions:

Small Wind Energy System: A wind energy conversion system (WECS) consisting of a wind turbine, a tower, and associated control or conversion electronics, which has a rated capacity of not more than 300 kW, and which is intended to provide electrical power for use on-site (either behind the meter or off-grid) and is not intended or used to produce power for resale.

Turbine: The parts of a wind system including the rotor, generator and tail.

Total System Height: The height from ground level to the tip of the rotor at its highest point.

Wind Turbine Tower: The guyed or freestanding structure that supports a wind turbine generator.

Wind Turbine Tower Height: The height above grade of the fixed portion of the wind turbine tower, excluding the wind turbine and rotor.

Off-grid: A stand-alone generating system not connected to or in any way dependent on the utility grid.

Behind the meter: A generating system producing power for use on a grid-connected property, but which system may or may not be capable of sending power back into the utility grid.

Section 4. Permitted Use:

Small wind energy systems shall be a permitted use in all zoning classifications where structures of any sort are allowed; subject to certain requirements as set forth below:

4.1 Wind Turbine Tower Height: It is recognised that small to medium wind turbines generally require tower heights of 24-50 m (80-164 ft) to reach wind currents reasonably adequate to generate energy. For property sizes between 0.1 ha (0.25 acre) and 0.2 ha (0.5 acre), the wind turbine tower height shall be limited to 80 ft (25m). For property sizes of 0.2 ha (0.5 acre) or more, there is no limitation on wind turbine tower height, subject to the set-back requirements below, and provided that the application includes evidence that the proposed height does not exceed the height recommended by the manufacturer or distributor of the system.

4.2 Set-back: The turbine base shall be no closer to the property line than the height of the wind turbine tower, and no part of the wind system structure, including guy wire anchors, may extend closer than three (3) m (10 ft) to the property boundaries of the installation site. Additionally, the outer and innermost guy wires must be marked and clearly visible to a height of 2 m (6 ft) above the guy wire anchors. The City/Region Board may waive setback requirements from adjacent properties if such adjacent property owner agrees to grant an easement binding on the current and future owners.

4.3 Sound: The mean value of the sound pressure level from small wind energy systems shall not exceed more than 6 decibels (dBA) above background sound, as measured at the exterior of the closest neighbouring inhabited dwelling (at the time of installation or during operation), for wind speeds below 22 mph (10 m/s) and except during short-term events such as utility outages

and/or severe wind storms. Applicants may apply for exemptions from this requirement with written authorisation from the pertinent building owner(s) and tenants, if applicable.

4.4 Approved Wind Turbines: Small wind turbines must be approved by a small wind certification or qualification program recognised by the Canadian Wind Energy Association.[13]

4.5 Compliance with International Building Code: Building permit applications for small wind energy systems shall be accompanied by standard drawings of the wind turbine structure, including the tower, base, and footings, anchoring method and drawn to scale. An engineering analysis of the wind turbine tower showing compliance with the International Building Code and certified by a licensed professional mechanical, structural, or civil engineer shall also be submitted. Documentation of this analysis supplied by the manufacturer shall be accepted. Wet stamps shall not be required.

4.6 Compliance with Air Traffic Safety Regulations: Small wind energy systems must comply with applicable air traffic safety regulations. A statement on compliance by the applicant is sufficient. Transport Canada must be notified of the location (latitude and longitude) and height of all wind turbine installations through the aeronautical clearance application process. Small wind turbine towers shall not be artificially lighted except as required by Navigation Canada.

4.7 Compliance with Existing Electric Codes: Building permit applications for small wind energy systems shall be accompanied by a line drawing of the electrical components in sufficient detail to allow for a determination that the manner of installation conforms to existing electrical codes, if applicable. This information frequently is supplied by the manufacturer.

4.8 Utility Notification: No grid-intertied small wind energy system shall be installed until evidence has been given that the utility company has been informed of the customer's intent to install an interconnected customer-owned generator. A copy of a letter to the applicant's utility is sufficient. No response or evidence of approval from the utility is required. Off-grid systems and grid-tied systems that are not capable of feeding onto the grid with advanced control grid fault protection and disconnect switches covered under the electrical code shall be exempt from this requirement.

If the proposed small wind energy system meets the above criteria, the [Municipality/Region] shall approve an application for the small wind energy system by right without a public hearing. For those proposed small wind energy systems that do not meet the above criteria, a zoning variance will be required.

Section 5. Severability:

If any provision of this Ordinance shall be held to be invalid or unenforceable for any reason, the remaining provisions shall continue to be valid and enforceable.

[13] Note that this provision should not be enforced until a North American certification program is in place for small wind turbines, expected by 2007.

5. Major Findings

5.1 RECOMMENDATIONS FOR CANWEA

In order to make the most of this research on siting small wind turbines, CanWEA can work to encourage Canadian municipalities and regions, as well as small wind turbine retailers and consumers, to adopt the model by-law and transform the recommendations into policy and purchase decisions, shaping the market for small with Canada in the years to come. While often seemingly on opposite ends of the debate, permitting officials and small wind turbine owners actually share common goals for effective zoning, to avoid onerous regulations without sacrificing the objective of protecting community resources and values. Encouraging open dialogue by sharing positive examples, and publicising the Step-by-Step Checklist included above in Section 3, are key "next steps" for CanWEA.

5.1.1 Tapping local expertise

An important resource available to promote better zoning and siting policies and practices are the small wind dealers and installers active in each local community. CanWEA would be well-served to tap their expertise and put it to greater use, helping local government officials understand the impacts of their well-intended, but sometimes overly complex permitting processes. CanWEA members have much to gain though collaboration with local governments. Everyone saves time and money when contention is removed and replaced with respect for effective process.

5.1.2 High priority short-term actions that can increase awareness

In the short term, CanWEA can take several steps to increase awareness about the need to establish reasonable policies distinguishing between different classes of wind turbines, including:

1) Format the "Best Practice" Guidelines and Checklist into an easy-to-digest 1-page flyer with weblinks for additional information, and work with small turbine manufacturers and distributors to provide copies to all prospective customers.

2) Ensure that each municipality receives copies of Section 4 above, perhaps with a cover letter endorsing the recommendations from a prominent national government official, along with an adequate supply of copies of the "Best Practice" Guidelines and Checklist for consumers and installers for use at local hearings and events to help publicise information resources available. If coordinated with a modest media campaign with press releases reaching out to newspapers serving the most active markets, such efforts could go a long way toward raising the education level of local citizens about small wind.

3) Hold workshops for and coordinate panels during regular meetings of organisations of local planning and permitting officials such as the Federation of Canadian Municipalities. Allow those with more experience to share their stories, drawing upon lessons learned in order to promote "Best Practices" in communities working to improve their regulations.

4) Provide ongoing support for planning officials who need to respond to questions from community members concerned about small wind turbines.

5) Conduct targeted direct mail campaigns, investing primarily in the postal codes with the best wind resources and other community characteristics that indicate promising markets for small wind turbines, modeled after the highly successful mailing campaign AWEA conducted in California in the aftermath of the 2001 "energy crisis."

5.1.3 Longer-term strategies

Additional effective techniques that CanWEA employ to facilitate small wind markets over the long-term include:

1) Propose and seek formal adoption of the model by-law at the national and provincial levels.

2) Develop positive case studies of installations that effectively served all stakeholders involved: the small wind turbine owner; the local community; the installer and manufacturer; and Canada as a whole. Widely publish these case studies on websites and seek publication in magazines, newsletters, journals and newspapers. Link these personal stories to larger issues, such as global climate change, volatility in oil and natural gas markets, the terrorist threat, and the emergence of a more intelligent power grid.

3) Team with small turbine dealers and installers to conduct trainings and public presentations on siting and zoning issues, as a direct interface with local government officials and prospective customers wanting to learn about the siting of small wind turbines.

4) Encourage installers and supporters to submit opinion columns and letters the editor of their local newspapers.

5) Where strong opposition arises, learn from controversy, and continue dialogue. Distinguish between issues of large commercial wind farm versus small on-site turbines, underscoring how all wind power applications are part of the solution.

5.2 CONCLUSION

While each locality presents unique challenges for siting small wind turbines for on-site power generation, useful "rules of thumb" are evolving as home owners, installers and local government officials gain more experience with this promising yet under-utilised source of clean electricity.

Most Canadian jurisdictions currently do not have ideal small wind planning and permitting regulatory regimes. However, most local governments are in the process of updating pr revising their planning and permitting protocols in light of growing interest in on-site wind power generation.

Local governments can use this study as a basis for reviewing their existing regulations or in drafting new regulations. The "Best Practice" Guidelines included in this study are tailored to the unique demands of Canadian governance systems. Likewise, the Model Zoning By-Law can serve as a solid starting point for those cities or towns wishing to develop well-thought out policies that accommodate the needs of the turbine owner, the small wind industry, and the greater community-at-large.

CanWEA members would benefit from a concerted outreach campaign to get the word out on these recommend siting guidelines and model zoning policies, including disseminating flyers, making public presentations, developing case studies of successful installations, networking with local government associations, and tapping Canada's small wind industry to convene educational and demonstration workshops. Direct mail campaigns can also play a key role to target scarce resources in regions with the most promise. The bottom line this study illustrates is that local governments, Canadian citizens and the small wind industry can work together to serve the greater public good by ensuring that planning and permitting of small wind turbines is affordable, streamlined, accountable and transparent.

Appendix A: Turbine-Specific Information

Small Wind Turbine Summary: Canadian and Major U.S. Models Available

Manufacturer	Company Base	Turbine Rating (kW)	Rated Capacity	Output based on Mftr Rating (10-25% Capacity Factors)	Manufacturer Reported Output	Tower Options	Sound Characteristics	Website
Electrovent	QC, CA	0.18	180 Watts	160-470 kWh/yr	NA	NA	NA	www.electrovent.com
Electrovent	QC, CA	0.36	360 Watts	320-950 kWh/yr	NA	NA	NA	www.electrovent.com
Southwest Windpower	AZ, US	0.9	900 W at 12.5 m/s	790-2,400 kWh/yr	1,200 kWh/yr with avg 5.4 m/s	NA	84.9 dBA*	www.windenergy.com/
Aeromag	AZ, US	0.9	900 W at 12.9 m/s	790-2,400 kWh/yr	1,800 kWh/yr with avg 5.4 m/s	6-22 m stainless and brass tilt	"barely noticeable" - untested**	www.aeromaxenergy.com/lakotamore.html
Bergey	OK, US	1	1 kW at 11 m/s	880-2,600 kWh/yr	2,320 kWh/yr with avg 5.5 m/s	9-30 m tilt-up, guyed	not distinguishable above background*	www.bergey.com/
Southwest Windpower	AZ, US	1	1 kW at 11.6 m/s	880-2,600 kWh/yr	2,400 kWh/yr with avg 5.4 m/s	NA	NA	www.windenergy.com/
Aerojoule	QC, CA	1.5	1.5 kW at 11.6 m/s	1,300-3,900 kWh/yr	NA	15-45 m lattice, guyed and nonguyed	NA	www.aerojoule.com/en/home.htm
Abundant Renewable Energy	OR, US	2.5	2.5 kW at 11 m/s	2,200-6,600 kWh/yr	4,800 kWh/yr with avg 5.3 m/s	13-38 m tilt-up, guyed	NA	www.abundantre.com
Lagerway	Netherlands	2.5	2.5 kW at 10 m/s	2,200-6,600 kWh/yr	8,294 kWh/yr with avg 5.5 m/s	12 m tubular, nonguyed	72 dBA at nacelle, 30 dBA at 20 m***	http://www.windenergysolutions.ca/documents/WES5tulipo_technical_specification_EN.pdf
Southwest Windpower	AZ, US	3	3 kW at 10.5 m/s	2,600-7,900 kWh/yr	6,000 kWh/yr with avg 5.4m/s	NA	NA	www.windenergy.com/
Aerojoule	QC, CA	3	3 kW at 11.6 m/s	2,600-7,900 kWh/yr	NA	15-45 m lattice, guyed and nonguyed	NA	www.aerojoule.com/en/home.htm
Aerojoule	QC, CA	4.5	4.5 kW at 11.6 m/s	3,900-12,000 kWh/yr	NA	15-45 m lattice, guyed and nonguyed	NA	www.aerojoule.com/en/home.htm
Abundant Renewable Energy	OR, US	10	10 kW at 11 m/s	8,800-26,000 kWh/yr	21,600 kWh/yr with avg 5.3 m/s	15-45 m lattice, guyed and nonguyed	NA	www.abundantre.com
Aerojoule	QC, CA	10	10 kW at 12 m/s	8,800-26,000 kWh/yr	NA	15-45 m lattice, guyed and nonguyed	NA	www.aerojoule.com/en/home.htm
Bergey	OK, US	10	10 kW at 13 m/s	8,800-26,000 kWh/yr	16,440 kWh/yr with avg 6.3 m/s	18-43 m guyed lattice, 18-30 m guyed tilt-up, 18-37 m free standing lattice & tubular	98.4 dBA*	www.bergey.com/
Aerojoule	QC, CA	20	20 kW at 12 m/s	18,000-53,000 kWh/yr	NA	15-45 m lattice, guyed and nonguyed	NA	www.aerojoule.com/en/home.htm
Wenvor	ON, CA	30	30 kW at 12 m/s	26,000-79,000 kWh/yr	NA	24 and 30 m tilt-up	NA	www.wenvortechnologies.com/
Atlantic Orient Canada Inc.	NS, CA	50	50 kW at 11.3 m/s	44,000-130,000 kWh/yr	87,000 kWh/yr with avg 5.4 m/s	25 m lattice	101 dBA*	www.atlanticorientcanada.ca
Entegrity Wind Systems Inc.	PEI, CA	50	50 kW at 11.3 m/s	44,000-130,000 kWh/yr	89,000 kWh/yr with avg 5.4 m/s	24.4 m & 30 m free standing lattice, tilt-up option	NA	www.entegritywind.com
Aerojoule	QC, CA	65	65 kW at 12 m/s	57,000-170,000 kWh/yr	NA	15-45 m lattice, guyed and nonguyed	NA	www.aerojoule.com/en/home.htm
Lagerway	Netherlands	80	80 kW	70,000-210,000 kWh/yr	NA	30 m tubular, nonguyed	NA	http://www.windenergysolutions.ca/02.htm
Northern Power Systems	VT, US	100	100 kW at 15 m/s	88,000-260,000 kWh/yr	300 MWh/yr with avg 8 m/s	25-32 m tubular	93.8 dBA*	www.northernpower.com
Lagerwey	Netherlands	250	250 kW at 12 m/s	220,000-660,000 kWh/yr	841 mWh/yr with avg 8 m/s	50 m tubular, nonguyed; 36 m lattice, nonguyed	NA	www.windenergysolutions.ca/

* Measurements include background noise and taken at 8 m/s wind with a reference microphone located downwind of the turbine at a distance equal to the hub height plus half the rotor diameter. See www.nrel.gov/docs/fy04osti/34662.pdf, www.bergey.com/Technical/AIAA%202004-1185.pdf, and www.windenergy.com/whisper100_Noise_Report.pdf

** At 11-13 m/s, as described on distributor's website: www.truenorthpower.com/Lakotasounds.html

*** At 9 m/s wind, from manufacturer's website: www.windenergysolutions.nl/products.htm

Appendix B: Resources

B.1 Publications and Non-Governmental Organisations

Canadian Wind Atlas: www.windatlas.ca

PEI Wind Atlas: www.gov.pe.ca/envengfor/windatlas/

CanWEA: www.smallwindenergy.ca/en/SmallWindAndYou/Planning/CrucialStuff.html
www.smallwindenergy.ca/en/SmallWindAndYou/Planning.html
www.smallwindenergy.ca/en/SmallWindAndYou/LegalRegulatory.html
www.smallwindenergy.ca/en/SmallWindAndYou/OtherConsiderations.html

American Wind Energy Association: www.awea.org/smallwind/toolbox/IMPROVE/zoning.asp

AWEA-NY model: www.aceny.org

"Small-Scale Wind Turbines: Policy Perspectives and Recommendations for the Municipality of the County of Kings," Dalhousie University School of Planning: plan.office@dal.ca

B.2 Government contacts

Incentives: http://incentivesandrebates.ca/gc_fi_search.asp

NRCan: www.canren.gc.ca/programs/index.asp?CaId=61&PgId=201

Transport Canada: www.tc.gc.ca/CivilAviation/Regserv/Affairs/cars/PART6/Standards/62119.htm

Navigation Canada: www.navcanada.ca

> TC Clearance Form and Instructions:
> www.canwea.com/downloads/en/PDFS/TC-AOCFormengl.pdf
>
> NavCan Procedures and Land Use Form:
> www.canwea.com/downloads/en/PDFS/NAV_CANADA_and_Wind_Energy_Developers.pdf
> www.navcanada.ca/ContentDefinitionFiles/Services/ANSPrograms/forms/NC10-0441_en.dot

PEI Canada Planning Act: www.irac.pe.ca/document.aspx?content=legislation/PlanningAct-SubdivisionAndDevelopmentRegulations.asp

West Grey, ON: www.township.westgrey.on.ca/zoning_bylaw.pdf
Zoning height requirements cannot limit height of wind turbine

Meaford, ON: www.meaford.ca/documents.cfm?categoryid=26

Clarington, ON: www.clarington.net/htdocs/building_index.html

Town of The Blue Mountains, ON:
www.thebluemountains.ca/intranet/files/documents/Approved%20Version.pdf

Municipality of Grey Highlands, ON:
www.greyhighlands.ca/files/departmentdocs/Discussion%20Paper%201%2024.8.04.pdf

Rockingham County, VA (U.S.): www.dsireusa.org/documents/Incentives/VA07R3.pdf

California (U.S.): http://info.sen.ca.gov/pub/01-02/bill/asm/ab_1201-1250/ab_1207_bill_20011007_chaptered.html

Michigan - small wind (U.S.):
www.michigan.gov/documents/Wind_and_Solar_Siting_Guidlines_Draft_5_96872_7.pdf

Strafford, VT (U.S.): www.trorc.org/pdf/towns/st/stzon060105.pdf

Wisconsin (U.S.): www.renewwisconsin.org/wind/Toolbox-Zoning/Small%20Wind%20System%20Model%20Ordinance-ver%201-16.pdf, http://www.awea.org/faq/sagrillo/ms_zoning5_right.html

B.3 Net Metering: Province by Province Resources

Nova Scotia: www.nspower.ca/RenewablesRFP/NetMetering.jsp

New Brunswick: http://fallsbrookcentre.ca/technology/net_metering.htm

Ontario: www.hydroonenetworks.com/en/electricity_updates/renewable_technologies/default.asp

PEI : www.gov.pe.ca/news/getrelease.php3?number=4419

BC: www.bchydro.com/info/ipp/ipp8842.html, www.bchydro.com/rx_files/info/info11776.pdf

Saskatchewan: www.saskpower.com/powerandenvironment/transmission/ppunder.shtml

Appendix C: Planner Interviews and Review of Existing By-laws

In order to analyze as much information as possible for this report, the study team developed and circulated a questionnaire to numerous planners and permitting officials across Canada, and conducted several interviews about specific policies governing height restrictions, setbacks from property lines, and sound restrictions for siting small wind turbines.

Research for this study included compiling and reviewing small wind by-laws in more than two dozen jurisdictions covering a wide range of population densities (with 2,000-500,000 residents across 220-4,400 km^2 resulting in 2-200 residents/km^2).The study team documented ordinances from: Charlottetown, PE, Malahide, AB, Clarington, ON, County of Grey/Niagara Escarpment/Town of the Blue Mountains/Municipality of Grey Highlands, ON, Pincher Creek, ON, and Meaford, ON, in Canada; and in San Bernadino, CA, Rockingham County, VA, Orleans, MA, NY (numerous local examples), VT, MI, WI, and MN, in the U.S.

Few of the Canadian local officials queried could provide specific or definite answers. Much of the most recent governmental activity has been in the provinces of Ontario and Price Edward Island (PEI). The focus, according a consulting planner for Grey County in Ontario, has been on developing policies for commercial projects.

> "Wind developers are knocking on the doors of all of these [Ontario] municipalities. At the local municipal level, we haven't had any filings on individual wind turbines, so we have been so focused on developing policies for commercial projects."
>
> *–Consulting planner for Grey County*

> "For example, in Southgate, if the wind turbine dominates the surrounding landscape, the visual impacts have to be addressed with setbacks. But these issues are addressed on a case-by-case basis."
>
> *–planner for County of Grey*

Local planners in Ontario County say they are also not aware of many permit applications for small wind turbines. A planner for the County of Grey explained that small wind turbines are allowed as a permitted use if the installations fulfill environmental assessment regulations. He noted that some municipalities (Southgate, Grey Highlands and Blue Mountain) are more advanced than others in developing siting policies.

Sound and electrical interference are also addressed by Southgate's current zoning requirements. Yet policies adopted in Southgate and the other two Grey County municipalities might not be ideal or mature models for other local governments to mimic. A backlash against large commercial wind projects could also affect small wind turbines. Still, this planner went on to note that at present small wind turbines can be sited almost anywhere, without widespread prohibitions. He noted that Grey Highlands had imposed a prohibition on commercial wind farm development for two years.

> "In the majority of cases, I do not think setbacks will be an issue. The latest generation of nacelles is so quiet, so I am not worried about noise, either. The whooshing noise [of the small wind turbine] is drowned out by the sound of the wind anyhow.
>
> *–planner for Meaford municipality*

"While BHCC is adamantly opposed to large-scale commercial turbine installations on Niagara Escarpment lands in the Blue Mountain/Pretty River Valley/Beaver Valley area, we are supportive of appropriate small wind installations by individual property owners and community groups. This position is outlined in greater detail…elsewhere on this website. We are enthused by the possibility of appropriately-sited small wind systems in our community, whether subject to the jurisdiction of the Niagara Escarpment Commission, the Town of the Blue Mountains or the Municipality of Grey Highlands."

–Blue Highlands Citizens Coalition website, www.bhcc.ca

A planner for Meaford municipality indicated that so far, Meaford has issued only one permit for a small wind turbine – a 10 kW machine that could supply all of the power for a residence. Meaford had no policies in place governing siting and installation of small wind turbines, but rather a "vague preference" for all forms of alternative energy. Municipal decision-makers allowed for an exception to the town's height restrictions based on old regulations designating water-pumping wind mills as a permitted use. He predicted that small wind for private power in the municipality of Meaford will be exempt from permits, except when safety issues arise. While this planner worried about the visual prominence of small wind turbines, he hoped that zoning officials and the small wind industry could "figure out a way to visually integrate these machines with the community." He was confident that small wind will be accepted throughout much of Canada.

"We decided [a water-pumping windmill] was close enough to a small wind turbine. We then allowed for a height exception up to the 100 foot tower height. At the moment, I believe folks could put up a small wind turbine on towers as high as 150 or even 200 feet. I do not see it as an issue. I think of it as a little like antennas for TVs in the 1950s. That only became an issue when there were too many."

–planner for Meaford municipality

A planner for the Town of Blue Mountains acknowledged the need for clearer policy guidance governing small wind turbines and noted that the Town is currently working on siting policies for small wind turbines for private use. He noted that one homeowner has already put up their own wind turbine a number of years ago, but wasn't even sure if it went through any kind of approval process. He noted that a more recent application for a small wind turbine did not meet some legal requirements in Grey County's zoning by-laws. At present, Grey County's zoning requirements restrict height of all buildings and structures to 11 m. The tower for the small wind turbine was not very tall, but even so it exceeded this limit, he pointed out. The proponent of the small wind turbine was granted a variance. This planner also acknowledged that he has recently received some additional applications for small wind turbines, and he supports small wind and other alternative forms of energy.

"Our existing by-laws were passed back in 1983. This by-law did exempt several structures from the zoning height restrictions, including church spires, radio antennas, silos, barns, water towers and 'windmills.' Since this is a rural area, we assume they were referring to the old water pumping windmills, not modern wind turbines. Both the project proponent and we at the planning department agreed we need some policy to address these issues."

–planner for Town of Blue Mountains

The Alberta municipality of Pincher Creek, which amended its 1989 small wind by-law in May 2005,

> "Unfortunately, with small scale systems, you bump up against NIMBY issues. And it is these same NIMBY people that turn their AC units on in summer to create our energy challenges. We all have to look at these issues together. The writing is on the wall, as our provincial government is encouraging alternative energy sources."
> *–planner for Town of Blue Mountains*

defines a Small Scale Wind Energy Conversion System as "a single structure with the capacity to produce no more power than can be consumed on-site, not connected to the grid." The new by-law includes strict sound limits and requires a sound analysis for adjacent properties located within 200 m of the turbine. Its set-back requirement is perhaps the highest in Canada, four times the height of the tower from the property line.

A development officer for the Municipal District of Pincher Creek No. 9 noted that permitting costs typically involve a non-refundable $500 deposit. She recommended that municipalities have long-term plans in place regarding land use by-laws and planning documents and re-visit them every 5-7 years.

Appendix D: Survey Responses

Question 1. What are the typical sound characteristics for the turbines you sell or install? Have you ever heard complaints from customers or their neighbours?

Out of 27 responses:
- 9 said the small wind turbines they install are quiet
- 7 said they had some concern about sound
- 3 said machines were noisier when furling in high winds
- 1 said smaller units created more sound than medium units (80 to 250 kW)
- 0 respondents said they had received any complaints about the sound coming from small wind turbines.

Most of those questioned were happy with the sound characteristics of the machines they sold or installed. One responded noted, "The sound of the Cyclone wind turbine is similar to the sound of the wind going through the spruce trees or popular trees without leaves. In fact, if you have trees nearby the wind turbine, the noise from the trees drowns out the noise from the wind turbine."

Another acknowledged some sound, but also progress. "Yes, some noise at high wind speeds, however turbine manufacturers are getting better day by day in making them quieter." Another acknowledged that the "typical sounds range from whirling to a moderate whining sound," but he also noted that "each [sound] is not very disturbing."

Question 2. What setback distance would you recommend from the owner's residence and/or neghbouring dwellings due to concern about sound?

Respondents used a variety of methods to measure these distances, ranging from feet, meters, acres and turbine heights, in describing setback requirements. Some saw no difference in distance between one owns home versus neighbours, while others did.

Out of 26 responses:
- 18 did not clearly distinguish between distances between turbine owner's home and neighbour's residence
- clearly offered different distances applicable to owner's home and neighbours
- 1 said no distance should be required for either homeowner or neighbour
- 1 said that small wind turbines should not be installed next to any building structures

Of those that replied, 6 relied upon tower height as a measuring device:
- 2 said one tower height setback (did not delineate between home/neighbour)
- 1 said one tower height plus blade
- 2 said two tower heights setbacks (one distinguishing between home owner)
- 1 said 1.5 tower height (no distinction between home vs. neighbour)
- 1 said 3 tower heights distance to neighbour

The majority of other respondents measured distances in feet or meters, but a few also used acres. After converting to common measurement in feet, here is summary of responses:

- 1 said 65 ft as distance from home and 100 ft to neighbour
- 1 said 25 to 100 ft (not distinguishing between home/neighbour)
- 1 said 50 to 100 ft (not distinguishing between home/neghbour)
- 6 respondents said 100 to 150 ft (2 referring just to distance from home)
- 2 used 1 acre (209 ft) as generic distance
- 3 said 300 ft equivalence to home
- 3 said 300 ft (not distinguishing between neighbours and home)
- 2 said 300 ft to neighbours
- 3 said over 600 ft to neighbours
- 1 said 1,000 ft (for mid-sized turbines)

Question 3. What sound levels should be allowed (i.e. 6 dBA) above background at closest neghbouring inhabited dwelling?

Of the 23 responses:

- 3 said 6 dBA is fair, though one of these respondents said there should be different sound requirements in residential vs. industrial areas
- 1 said 40 dBA at 20 m distance (~60 ft) at 9 m/s wind speed
- 1 said "at least 10 dBA higher than ambient sound level"
- 1 said "less than 40 dBA"
- 1 said sound levels from small wind turbines he sells are "approximately 60 dBA" and that this level of sound "could be considered tolerable"
- 1 said "sound levels should be based on 'normal operating conditions" and not on "extreme conditions of power outage or wind storms."
- 2 said there should be exemptions during times of high wind/storms
- A majority (11) said the sound from small wind turbines does not warrant regulatory limits.

Question 4. What tower height limitations and property line setbacks do you recommend (for ¼ acre, ½ acre, 1 acre, etc.)? Why?

Out of 24 responses:

<u>Tower height</u>

- 3 said 60 ft for ½ acre lot; larger up to 120 ft
- 1 said 80 ft, property dimensions at least twice height of tower
- 1 said 100 ft for 1 acre lot
- 1 said tower height should not be limited other than where it can not be accommodated within lot lines.

<u>Property line</u>

- Trees near a lot line may fall on a neighbour's yard and insurance will cover it. If you can drill a fence post hole ON a lot line you should be able to put an anchor inside the lot line.
- 16 said based on tower height

- 20-30’ from property line
- Setbacks should be about 2/3 of tower height from tower to lot line.
- 6 said 1 tower height from property line
- Habitable structures (homes, offices, schools) should have a setback of 1 tower height. Non-habitable structures (industrial complexes, barns, storage facilities, etc) should not be subject to setbacks. Habitable structures on adjacent property should be two to three tower heights.
- 110% of tower height
- We recommend a minimum of tower height plus 30% as a setback. In the unlikely event that the tower were to come down, it should not be able to land on anyone or anything not belonging to the owner. This will help limit the liability of the turbine and the owner should something go wrong.
- 5 said 1.5 times height of tower including blades
- 1,000 ft from neghbouring residences
- No property size requirements – municipality would discriminate against 80-90% of residences
- 1/2 acre or larger lands
- 2 said written permission from adjacent property owners should be able to be given to make these distances less
- 2 said 1 acre minimum lot size
- 2 acres for 3 kW turbine, less for smaller
- 2 said 3 acres needed due to consideration for neighbours, sound and visual impacts
- Universal for all plots
- 2 said site specific
- Safety and insurance concerns (one noted that not all turbines pose the same level of risk and recommended that individual turbine risks and safety records be taken into consideration)

Question 5. Do you believe any restrictions should be placed on installing turbines on ridgelines and/or visually sensitive areas? If not, why not?

Out of 26 responses:
13 responded that no restrictions should be placed on small-scale wind turbine installations, for reasons including:

- conventional power sources, utility lines, and cell phone towers are just as visible and are tolerated; wind should be treated the same (5)
- Wind installations are necessary to help reduce our ecological footprint, and to help ease the burden we are putting on our electrical grid (2)
- Many people like the look of wind turbines, especially more than smoke from a coal plant (2)
- higher visibility is usually accompanied by better wind speeds
- the benefits of wind power, especially to farmers, far outweigh any drawbacks (2)
- wind is greener and cleaner than other options of producing power
- Simply because someone doesn't want to look at it shouldn't allow it to be restricted.
- Visually sensitive arrays are highly subjective.

11 responded that limited restrictions may be appropriate such as:

- Tiered restrictions should be reviewed and applied on a case-by-case basis; every situation is different (3)
- If the area has a visual easement as a precondition
- If ridgeline is part of a significant, scenic tourist area due to possible impact on wind industry
- Historic sites or if the ridge is an environmental protected space (i.e. Ducks Unlimited, Endangered Species Area, etc)
- Treat small wind turbines the same as communications towers and ham radio antennas (2)
- Turbines with blade spans of less than 20 m on towers under 35 m have a much smaller visual impact than large wind farms (3)
- Sites below the ridgeline may shorten the life of the unit due to the turbulence effect.
- For land use agents and concerned interveners to decide.

4 responded yes, restrictions are appropriate for visually sensitive areas:

- A review and guidelines should be prepared for a council or authority within the region to determine which are protected for scenic beauty and pleasure.
- To prevent the countryside from looking like Germany where some feel the wind turbines are a disincentive to tourism.
- In otherwise unoccupied natural settings, but anywhere any other towers (i.e. cell towers) or structures are installed should be fair game for wind turbines.
- Turbines installed in these types of areas create bad press and generally negative opinions which are not helpful for the industry as a whole.

Question 6. Do you believe that it is appropriate to classify "mini" wind turbines (up to 1 kW), small wind turbines (up to 30 kW) and/or medium wind turbines (up to 300 kW) as a permitted or accessory use, providing specified requirements are met? Should this classification apply in all zoning classifications where structures of any type are allowed, thereby eliminating the need for public hearings? If you do not think is appropriate to classify all small-scale wind systems (up to 300 kW) as permitted or accessory uses, would you support the creation of a tiered application process that allows uncontroversial projects to proceed on a faster track?

Out of 25 respondents:

- 17 respondents essentially agreed with this proposal, although one of these disagreed specifically with the second part of the proposal (all turbines up to 300 kW classified as permitted or accessory use *in all zoning classifications*).
- 2 respondents indicated that *size* is not the important distinction. Of these, one argued for classification based on *use* (i.e., *for personal use* as opposed to power produced for resale); the other argued that *sound* rather than size should be the determining factor in permitting.
- 4 respondents favored the idea of classifying small wind turbines as accessory uses, but had very different ideas about where to set the thresholds:
- One respondent, whose clients all live “off-grid,” argued for defining small wind turbines as “up to 3 kW”
- Two respondents suggested setting the medium size at 500 kW; in one case, the basis of this

response was so that all turbines under the net metering program would be classified as accessory uses; in the other case, the argument was that classification should be consistent with the Distribution service code (which tied in with the LDC and ESA).

- One respondent argued for designating all turbines under 100 kW as "small turbines for personal use" and that anything over 100 kW should be classified as commercial and permitted accordingly
- 2 respondents favored the idea of classifying turbines as accessory uses, but opposed the idea of a two-tiered application process as "more red tape."

Question 7. What do you believe is a reasonable permitting fee (in dollars or as a percentage of equipment cost) for small wind turbines? (e.g., for permit administrative costs, application processes expenses and inspections)

Out of 25 responses:

- 7 respondents gave a recommendation of $0
- 7 respondents gave a dollar value of between $20 and $200
- 1 respondent gave a dollar value of $500
- respondents gave a recommendation of whatever the going municipal rate is for a home renovation. 2 of these respondents recommended that the Federal government then offer this fee back as a rebate to the consumer.
- 1 respondent had no idea what to recommend
- 3 respondents chose not to respond to the question

Question 8. What public safety measures do you recommend (i.e. guy wire markings)? Do you feel that fencing or lighting should ever be required? If so, under what circumstances?

Out of 25 responses:

- 11 respondents recommended marking guide wires
- 7 respondents recommended that some applications may require fences or shields to prevent unauthorised tower climbing
- 4 respondents felt that no fences should be required
- 12 respondents recommended that only lighting required on all tall structures by flight authorities should be required
- 1 respondent recommended requiring a clear tower fall zone
- 1 respondents recommended marking anchors in addition to guide wires
- 1 respondent recommended locking gin pole to prevent unauthorised raising
- 2 respondents recommended High Voltage/ No Climbing warning signs

Question 9. What electrical and tower safety measures do you recommend (i.e. line drawings, engineering analysis)?

Out of 24 surveys:

- 1 respondent recommended certification of technicians
- 1 respondent recommended engineering drawings were unnecessary

- 11 respondents recommended requiring line drawings for all installations
- 10 respondents recommended requiring installation of towers that had undergone an engineering analysis by manufacturer and were specifically rated to carry a specific turbine
- 1 respondent recommended that wires be routed inside tower and buried
- 2 respondents recommend requiring ESA inspections
- 1 respondent recommends requiring lightning protection
- 1 respondent recommends requiring proper grounding
- 1 respondent recommends requiring that certified electricians complete the installation

Question 10. What federal or international standards, building codes, electric codes, and air traffic regulations do you recommend local jurisdictions refer to for compliance?

Out of 23 respondents:
- 17 respondents recommended that existing codes were sufficient (electrical codes and other codes that apply to all towers)
- 1 respondent recommended that the CEC should be amended to include a wind specific section (similar to that for PV)
- 1 respondent recommended that UL 1741 be modified to cut down the required wait time before a wind system can reconnect to the grid (down from 5 min)
- 1 respondent recommended that building codes not be applied to wind towers
- 1 respondent recommended that all turbines undergo international certification
- 1 respondent recommended creating a code of practice for all installers and municipalities

Question 11. Do you believe utility and/or neighbour notification should be mandatory? If not, should it be encouraged?

Out of 25 respondents:
- 13 respondents recommended that the utility be informed in the case of grid connected turbines
- 2 respondents recommended that the utility need not be informed if there are guidelines that are followed stringently. One of these thought the question offended his rights as a Canadian
- 5 respondents recommended it be required to notify neighbours
- 15 respondents recommended neighbour notification be recommended but not mandatory
- 7 respondents recommended that utility notification be recommended but not mandatory.

Appendix E: Communicating With Your Neighbours

Communicating with your neighbours about your plans to install an on-site wind turbine can prevent opposition fueled by lack of familiarity with small wind systems. A short letter like the one below can answer most questions, correcting misperceptions and letting your neighbours know that you have properly researched the project.

Dear Neighbour,

You may be interested to learn that I plan to install a small wind energy system on my property at [address]. This modern, non-polluting system will generate electricity for my own use, reducing my dependence on the local utility. Any excess generation will be supplied to the utility system.

I plan to install a [turbine make and model] that will be mounted on a ____-meter (___-foot) wind turbine tower, set back ___ meters (____ feet) from the street and ____ meters (____ feet) from my [north/east/south/west] property line. This turbine uses a [two/three] bladed propeller ___ meters (___ feet) in diameter. It does not turn until the wind speed reaches at least __ m/s (___ mph). On calm, quiet days the turbine will not likely be audible. When the rotor is turning, the sound of the wind passing over the blades will register about __ decibels (dBA) at a distance of ___ meters (___ feet), which will barely be audible from neighbouring residences over other sounds caused by the wind.

[Manufacturer] has installed [number] of [turbine make and model] in Canada and elsewhere in North America [and overseas]. They have a proven track record of producing energy quietly, cleanly, and safely. If you have any questions about the proposed installation, please feel free to contact me.

Sincerely,
[Prospective wind turbine owner]