Ontario Landowner’s Guide to Wind Energy

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The Ontario Sustainable Energy Association (OSEA) is an association of individuals and groups working to develop sustainable energy projects in their communities. Our communities are the largest scale at which most of us feel personally connected and capable of direct, meaningful participation. They are also the smallest scale at which it is possible to mobilize the resources needed for a major initiative. OSEA works to bring together these local efforts on a provincial scale.

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Foreword

Wind energy is a rapidly growing business worldwide, representing a multibillion dollar industry. Though wind energy is relatively new to Ontario, there are a burgeoning number of wind turbines being proposed for the province. At the time of writing, there was 14.6 megawatts (MW) of wind generating capacity installed in Ontario, and over 2,000 MW in development. The Ontario Sustainable Energy Association (OSEA) estimates that there is more than 24,000 MW of wind energy potential in southern Ontario.

Over the past several years, wind developers have been prospecting for windy sites in southern Ontario, predominantly along the shores of the Great Lakes and along the Niagara highlands as possible locations for large wind farms. In many areas rural landowners, especially farmers, have received offers to lease their land from these wind power developers. It became apparent that a written guide for landowners considering wind power development would be a valuable tool.

The following ‘Ontario Landowner’s Guide to Wind Energy’ is in no way exhaustive. The primary focus of this guide is on large wind turbines greater than 750 kW in size. There have been several guides written for rural landowners in dealing with wind energy, big and small, as well as numerous books written about the technology. See Appendix E at the end of this document for Sources of Additional Information.

This guide should not be used as a source of legal advice. Developing wind energy, investing in a wind turbine, or entering long-term land leases is a complex undertaking. While OSEA can offer general information about wind energy and especially about community-based wind power development, OSEA does not provide legal advice.

As an association, OSEA is comprised of individuals and groups working to develop sustainable energy projects in their communities. Sustainable energy projects use renewable technologies such as wind, solar, micro-hydro and biogas. They range in size from 50 kW to over 20 MW. Some communities hope to retain 100% of project control and management, while others only wish to have a small portion of project ownership and/or management.

OSEA has provided hundreds of seminars to landowners, farmers, municipalities and communities in Ontario. OSEA has worked on this guide in cooperation with agricultural associations such as the Ontario Federation of Agriculture (OFA) and the National Farmers Union (NFU), our member organizations developing wind power in Ontario and with industry associations such as the Canadian Wind Energy Association (CanWEA).
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1. An Overview of Wind Technology

Humans have been harnessing wind power for centuries, to sail ships, grind grain and generate electricity. Over the past two decades, remarkable progress in wind technology has brought large-scale turbines to the forefront of modern electricity generation. The following section provides an overview on how these modern engineering marvels operate and how they may benefit Ontario landowners.

1.1 Horizontal and Vertical Configurations

All the wind turbines installed to date in Ontario, and all those slated to be installed are of a conventional configuration (see Figure 1: Wind Turbine Configurations). Though wind turbines can be built in many different shapes, all large wind turbines available commercially, such as those that will be used in Ontario, resemble an airplane propeller mounted atop a tall tower. They will use three blades and the rotor will spin about a horizontal axis upwind of the tower.

1.2 Basics of Operation

Typical wind turbines begin rotating in winds of 4 m/s and will continue turning (coasting) in winds as low as 3 m/s (see Table 1 below for speed conversions). Wind turbines will generate electricity in winds from 4.5 m/s to 25 m/s. At windy sites, wind turbines will be in operation about two-thirds of the time (~6,000 hours per year).

In high winds, often in excess of 25 m/s the wind turbines will automatically stop the rotor by pitching the blades. This slows the rotor until a parking brake can be applied, bringing the rotor to a complete halt. Often, the rotor will not brake to a stop but will spin slowly even when it is not generating electricity. This keeps the rotor bearings lubricated.

<table>
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<th>5 M/S</th>
<th>6 M/S</th>
<th>7 M/S</th>
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1.3 Size of Machines

Wind turbines vary widely in size. The smallest wind turbines, such as those used on sailboats to charge batteries, use rotors less than 1 meter in diameter and can be carried in your hands. Household-size wind turbines are much larger. They can have rotors from 3 to 15 metres in diameter, and weigh from less than 50 kilograms to thousands of kilograms. Commercial-scale wind turbines are large machines standing 80 to 100 metres tall with nacelles the size of tractor trailers (see Figure 2 Relative Size of Wind Turbines).
To gauge the size of a wind turbine, always consider its rotor diameter first. The diameter is approximately twice the blade length.

It is the rotor that captures the wind, not the generator. For example, consider two typical wind turbines on the market today. One wind turbine uses a rotor 80 meters in diameter. Its rotor sweeps an area of 5,000 m² and its generator is rated at 1.8 megawatt (MW) (see Figure 4: Wind Farm in Ontario). The second wind turbine with a rotor of 82 meters in diameter sweeps an area nearly 5,300 m² of the wind and driving a generator rated at 1.65 MW. The second wind turbine, even though it uses a smaller generator, is larger than the first and will typically generate more electricity.

1.4 Generator Variations

The wind turbines used in Ontario will typically use a gearbox or transmission to increase the slow speed of the rotor to that required by the generator. Some, such as the WindShare turbine at Exhibition Place in Toronto, do not use a gearbox and instead the rotor will drive the generator directly (see Figure 5 Wind Turbine Nacelles).

1.5 Towers

Wind turbines can be installed atop guyed or unguyed towers. Due to their size large wind turbines in Ontario will be installed on unguyed towers, while some smaller and medium sized turbines may be installed on a guyed tower. Large wind turbines will use either a large diameter tubular tower or a lattice tower like those used for high voltage transmission lines (see Figure 6: Typical Wind Turbine Towers: Tubular & Lattice). Because of Ontario’s harsh winters and concerns with nesting birds, it’s likely that all wind turbines installed in Ontario will use tubular rather than lattice towers.

1.6 Wind Turbine Cost

Prices quoted by a manufacturer will be based on the size of the generator in cost per installed kilowatt (kW). The installed cost includes feasibility, interconnection and engineering work. Wind projects benefit by economies of scale, primarily because the development and operation costs of a single wind turbine is similar to a multi-turbine facility. Therefore, it is usually more cost effective on a per turbine basis to build multi-turbine facilities than it is to build a single machine.

Currently (2005), a large wind turbine will cost $2,000 to $2,500 per kilowatt (kW) of installed capacity. For example, a single 1.5 megawatt (MW) wind turbine with a rotor diameter of 77 meters that sweeps 4,650 square meters (m²) will cost $3 to $4 million installed.

It is more instructive for a landowner to measure the cost of a machine by the area swept by the blades of the turbine. There is
no international standard that determines how big a generator should be used inside a wind turbine. The common practice of costing a wind turbine by its generator size in kW or MW is not useful in determining the cost of electricity produced, however, it can be used to calculate the installed cost of a turbine. The 1.5 MW turbine used in the example above would have a cost of $650 to $850 per square meter of the area swept by the wind turbine’s rotor.

1.7 Measures of Productivity and Performance

It is common among wind project developers to compare wind turbine productivity in terms of Capacity Factor, which compares the plant’s actual production over a given period of time with the amount of power the plant would have produced if it had run at full capacity. While commonly used, it does not correlate directly to the energy generation potential of a turbine and therefore the revenue the turbine can generate¹.

OSEA recommends that landowners use the Annual Specific Yield (ASY) of a wind turbine to determine its revenue generating potential. The ASY provides the number of kilowatt-hours per square meter of rotor swept area per year (kWh/m²/yr). This enables landowners to compare the amount of electricity wind turbines will produce regardless of their generator ratings. For an example of how to use the swept area of a wind turbine to estimate the amount of electricity a wind turbine will produce see Table 1 in Appendix A for a listing of the Standard (Nominal) Power Rating & Swept Area.

A simple method that can be used by landowners is to find the average annual wind speed at the hub height where the wind turbine will operate and multiply the annual electricity yield in kWh/m² by the area swept by the wind turbine (see Figure 7: Annual Energy Output (AEO) Relative to Rotor Swept Area).

2. Wind Turbines in Ontario

Wind power is a growing source of electricity generation in Ontario. The provincial government has set a renewable energy target of 5% of the electricity supply to come from renewable sources by 2007, increasing to 10% by 2010. With a favourable wind regime, a stable political climate, and continued demand for renewable power, wind promises to be a significant component of the provincial electricity supply for decades to come.

2.1 Installed Wind Capacity

As of May 2005, there is 14.6 MW of installed wind power operating in Ontario. To see, feel, and hear what large modern wind turbines are like, visit these wind locations:

- Kincardine: A 9 MW wind farm, Huron Wind, owned by Ontario Power Generation (OPG), Cameco, TransCanada Pipelines & Borealis

¹ Capacity Factor is a measure used commonly in the electrical industry and works best for traditional sources of generation (such as fossil fuels). For intermittent resources such as wind power, the Annual Specific Yield is a more useful measure.
Tiverton: A 600kW Tacke turbine owned by OPG
Port Albert: A 660 kW Vestas machine owned by Epcor
Ferndale: A 1.8 MW Vestas turbine owned by Sky Generation
Pickering: A 1.8 MW Vestas turbine owned by Ontario Power Generation
Toronto: A 750 kW Lagerway turbine owned jointly by the community co-operative WindShare and Toronto Hydro.

2.2 **Ontario’s Wind Resource**

Ontario has a suitable wind resource for the development of wind power projects. The strongest winds are found along the shores of the Great Lakes and areas with high elevations and exposure to prevailing wind directions. At best, commercial-scale wind turbines in Ontario will generate the following:

- **High**: 1,100 kWh/m²/yr
- **Moderate**: 750 kWh/m²/yr
- **Low**: 500 kWh/m²/yr

An average 1.5 MW wind turbine in Ontario will generate 2,325,000 kWh of electricity per year in a low wind regime. In a high wind regime the same turbine would produce 5,125,000 kWh of electricity per year. This is the equivalent energy consumption of between 250 to 450 Ontario homes during the year.

There are a number of resources available to landowners to get a preliminary indication of whether you live in an area suitable for wind development. Environment Canada has created the Canadian Wind Atlas at [www.windatlas.ca](http://www.windatlas.ca) which provides color maps representing the average wind velocity and power across Canada.

In 2005, the Ministry of Natural Resources released [www.ontariowindatlas.ca](http://www.ontariowindatlas.ca), a more detailed online map of Ontario’s wind regime. This map and database has a resolution of 1 square kilometre with a potential of 100 metre resolution in areas where wind speeds at 80 to 100 metres in elevation are equal to 7 m/s or greater than 8.8 m/s. Wind profiles are provided at 10m, 30m, 50m, 80m and 100m.

2.3 **Provincial Procurement of Wind Power**

Due to a provincial price cap on the retail price of electricity, there is a gap between the low cost consumers pay for their power and the higher cost to generate power from wind. Therefore, wind developers in Ontario require long term power purchase agreements at a price that provides enough financial incentive for the development of wind turbine projects.

In November 2004 the Ontario government announced long term contracts to develop nearly 355 MW of new wind power.
In April 2005 the government issued a subsequent Request for Proposals (RFP) for renewable power projects that will add an additional 1000 MW of wind power. OSEA estimates that there is in excess of 2,000 MW of wind power projects currently under development in Ontario.

The Ministry of Energy is currently evaluating the implementation of Standard Offer Contracts (SOC) for small community-based projects. These contracts would enable landowners to sell their electricity commercially for a fixed rate for a fixed term and guarantee the right to interconnect to the electrical grid. If this mechanism is enacted landowners will have more choices as how best to use wind energy through net metering, leasing land to a wind project developer, or developing wind energy themselves. For more information, please visit www.communitygreenpower.ca.

### 3. Models of Wind Development

Wind turbines are modular. They can be installed in projects as small as one wind turbine or in projects of hundreds, even thousands of machines. For example, there are nearly 4,000 wind turbines in California’s Tehachapi Pass. However, in Europe where the population densities are higher, wind turbines are installed in much smaller groups than that found on the vast range lands of western North America.

#### 3.1 Individual Wind Turbines & Clusters

The settlement pattern in Ontario more closely resembles that of northern Europe than it does the Prairie Provinces. Because each parcel of land is smaller than in Alberta and there are more people living on the land, wind turbines will be installed in much smaller groups than in the Prairies. As seen in Figure 6, wind turbines may be installed in single units.

Nevertheless, there are fixed costs for a wind project of any size, especially the costs for planning and approvals. When these costs are spread across several wind turbines, the relative cost per wind turbine decreases. Thus, wind developers try to build a cluster of wind turbines that will support the initial project development costs. Clusters can contain from two to ten turbines (see Figure 9 Cluster of Wind Turbines).

#### 3.2 Wind Farms

Further economies of scale are gained by adding more and more wind turbines to a project. There are several wind farms or wind power plants proposed for Ontario. Some of these projects will contain more than 60 wind turbines (Figure 10 Wind Turbines on Tilled Land).
4. Models of Participation

There are several ways that landowners can participate in wind energy ranging from direct ownership to leasing land to a wind developer. Landowners can install a smaller wind turbine to offset their own electricity consumption, they can install a wind turbine themselves or jointly with others for selling electricity to the grid or they can lease land to a wind developer. Each option has different risks and rewards.

4.1 Individual Land Lease to Developers

Through the end of 2004, most wind energy development activity in Ontario was concentrated on leasing land from Ontario landowners for commercial wind farms. In this form of development, the landowner leases their land, or a portion of their land to a developer (such as a private corporation or co-operative) that will install, own, and operate the wind turbines. This is more of a real estate transaction than direct participation in a wind operation.

The developer will sell the electricity generated by the wind turbines to a customer under a long-term contract. The landowner will receive rent or a royalty for the use of their land for the period of the lease. Most wind projects in North America are developed in this manner. However, this is not always the case. In Europe many wind turbines are owned by the landowners themselves or owned jointly with others.

When a landowner leases land to a wind developer, most of the financial, technical, and legal risk is borne by the developer. The landowner’s principal risk is entering a long-term agreement with a company in which the landowner has limited decision making ability regarding the design and operation of the facility. Although landowners are typically apprised of the business plan (including type of wind turbine, maintenance plans etc.) at the time of signing the lease, other aspects of the business are made by the wind developer.

Leasing land for wind development is a trans-generational decision. Leases with the landowner typically run with the land, and are therefore applicable to the landowner, subsequent landowners and their heirs. Leases will run for a minimum of 20 years, and in some cases will continue for up to 50 years.

4.2 Pooled Landowner Land Lease to Developers

Most often in North America wind project developers lease land from individual landowners. Developers lease the land to install their wind turbines or ancillary structures such as roads, transformers, substations, and power lines.

Although some leases provide payments for neighbouring properties that don’t have turbines or ancillary structures on them, others do not. This can cause ‘turbine envy’ for those properties that have no turbines and no financial benefit from the project.
Northern Europeans have long confronted this issue and have devised pooling arrangements among neighbouring landowners. The land association or pool leases the land to the wind development company. In this way all the landowners receive some compensation from the wind project even if they do not have a wind turbine installed directly on their property (see Appendix D Land Pooling Among Neighbouring Landowners).

Some wind developers have proposed similar arrangements in Ontario where neighbouring landowners receive a portion of the royalties as a percentage of their land in the pool. OSEA encourages the use of pooling arrangements to create more equitable projects for all landowners.

4.3 Install Your Own Wind Turbine

In Germany, Denmark, and the Netherlands many large wind turbines are owned by the landowners themselves. The landowner develops, owns, and operates the wind turbines or contracts others to do so. Unlike leasing land to a wind developer, the financial, technical, and legal risk is carried by the landowner. All management decisions are made by the landowner. On the other hand, all the financial benefits accrue to the landowner as well.

In Europe, there are numerous institutions, such as banks, consulting companies, service contractors and so on, that make installing your own large wind turbine possible. Few of these services currently exist in North America outside Minnesota and Iowa. However, OSEA is working with government and industry to establish similar support mechanisms with the goal of creating opportunities in Ontario.

4.4 Net Metering: Offset Household Electricity Consumption

Landowners in Ontario will soon have the ability to install wind turbines up to 500 kW in size on their property to offset their own electricity consumption. Currently, net metering is available for projects that produce up to 50 kilowatts. However, this is at the discretion of local energy distribution companies. New regulations to be introduced by the provincial government in 2005 will change the current situation and require that distributors permit net metering for all eligible projects that are up to 500 kW.

When the wind turbine is operating, electricity produced is used to offset consumption. Under Ontario’s proposed net metering system, the landowner is permitted to feed excess generation from the wind turbine into the grid during periods of high winds and low on-site consumption. In effect, the household electricity meter is spinning backwards, crediting the landowner for the surplus electricity produced. During periods of low or no wind and high on-site consumption, the electricity is delivered from the local utility, and the meter spins forwards at the expense of the household (see Appendix E for contact information regarding net metering).
4.5 Joint Development: Shared Ownership in Wind Turbines

In Germany, Denmark, and the Netherlands, many wind turbines are owned jointly by neighbouring landowners, or owned jointly with investors from neighbouring communities. The landowner may not own the wind turbines in their entirety but may own an equity interest. As such, the development risks are spread over many investors while providing the landowner with some say in the management of the wind project. In Ontario, Toronto residents purchased shares in WindShare, a community co-operative which jointly owns a 750 kW wind turbine with Toronto Hydro at Exhibition Place in Toronto.³

If the landowner owns a share in a co-operative, for example, they have one vote on management issues regardless of the amount of shares owned (see Figure 11 Co-operatively Owned Wind Farm in Copenhagen). If the landowner is an equity participant in a corporation they receive the number of votes on management issues in proportion to their ownership. In shared ownership, the landowner may receive a royalty for land rent plus a percentage of returns from the business, whether a co-operative or corporation.

5. Development of a Wind Turbine Project

Developing a wind project in Ontario requires a good wind site, technical and project development expertise and significant financial resources. The following section outlines the primary steps a developer undertakes to develop a wind project.

5.1 Wind Resource Assessment

To determine the wind resource at a specific site it is often necessary to install a meteorological mast that supports several wind measuring instruments: wind vanes, and wind speed sensors (anemometers). The masts are typically slender guyed towers 60 meters (197 feet) tall tipped into place with a winch and gin pole (see Figure 12 Wind Resource Assessment). The wind developer or meteorologist will also install an electronic data logger on the mast or at the base of the mast.

For areas where there is severe icing during the winter, the instruments are heated, requiring a reliable source of electricity. This can be provided by solar panels and batteries or by a connection to the electricity network. Measurements for twelve months or more are often required to accurately assess the wind resource.

The data collected is then extrapolated to the height at which the wind turbine operates — its hub height. Average annual wind speeds in Ontario will vary widely, from a low of 4 m/s to a high near 7 m/s at hub height.

Meteorologists use the data collected from the wind energy masts...
to calculate the amount of electricity a wind turbine will generate. Depending on the requirements and capabilities of the landowner or developer, the meteorological assessment of a site with a full year of data collection can cost from $25,000 to $45,000.

5.2 Environmental Assessment

In Ontario, a wind developer may be required to perform either a provincial or a federal environmental assessment (EA). This will depend on:

- Size of the project
- Location of the project
- Federal involvement

In Ontario, a wind turbine project less than 2 MW will not require a provincial EA. However, if the project is located on crown land and is less than 2 MW the Ministry of Natural Resources will complete an Environmental Screening Report (ESR). For all projects that are greater than 2 MW in Ontario a provincial EA is required. The provincial EA process is covered under Ontario Electricity Projects Regulation 116/01.

Federally, there is no requirement to perform an EA unless there is a financial or project contribution by the federal government (such as receiving funding from Wind Power Production Incentive) or there is a known environmental consideration to the project (such as location near a migratory bird route). The federal EA process is administered by the Canadian Environmental Assessment Agency.

Additional studies required through the provincial and federal environmental assessment process includes the following:

- Bird & Wildlife
- Hydrology
- Agriculture
- Archaeological & Cultural
- Public Consultation
- Noise & Visual
- Socio Economic

There are numerous professional consulting firms in Ontario that provide EA services. The Canadian Wind Energy Association has a members’ directory on their website www.canwea.ca that will provide contact information for a number of the firms.

To minimize their visual intrusion, wind turbines will be painted neutral colors and should not use logos unless small and unobtrusive. Logos are a form of advertising and some communities prohibit advertising on wind turbines, such as in Riverside County, California (see Figure 13 Logo Free Turbines). For a discussion of aesthetics or how wind turbines appear on the landscape see the book *Wind Power in View* listed in Appendix E Sources of Additional Information.
5.3 Community Issues
Aesthetics, avian mortality and noise levels are the three most common issues surrounding wind energy that may concern the community. Addressing these concerns early in the development of a wind power project leads to greater community acceptance and project success. OSEA recommends that a comprehensive and inclusive public consultation process be an integral component to the development of all wind power projects. Community open houses, door-to-door visits, and trips to nearby wind turbines are some of the tools that can contribute to greater project acceptance.

In some communities wind project developers may provide community benefit funds. Some wind developers in Europe have offered as much as 1% of gross revenues for community development. One North American developer offered 1% of net revenues (a much lower sum). Some developers offer a one-time fee to the local community, others a regular or annual payment, others have undertaken a particular community service project. For example, in France one wind project paid for restoration of a local historical windmill.

Large wind turbines require roads for access by cranes and heavy vehicles. They will also require an excavation for the foundation typically about the same volume as a small house foundation, as well as trenching for the power cables. Wind turbines are large structures and will be visible for some distance. Some turbines installed in Ontario will require aviation warning lights.

Wind turbines, with their large rotors spinning in the wind, will make sounds unique to wind turbines—the swishing of the blades and the hum of the generator—that will be new to the rural landscape. The sounds that a wind turbine makes will be audible for 250 to 350 metres from the base of the wind turbine. These sounds will measure between 35 to 45 dB(A)\(^4\) which is the same level as a quiet conversation.

As large structures, wind turbines can and will kill insects and some birds and bats that fly into them. Wind turbines will not affect other wildlife or cattle. During its first year of operation, the wind turbine at Exhibition Place in Toronto killed only two (2) birds. In comparison, the high rise structures in downtown Toronto are estimated to kill 10,000 birds per year\(^5\).

6.1 Land Area Used by Wind Turbines
Well designed wind projects take very little land area out of cultivation. They occupy much more land than they actually use because each wind turbine must be a certain distance from the next. This spacing allows each wind turbine to best capture the wind. When

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\(^4\) Measurements of environmental noise are usually made in dB(A) which includes a correction for the sensitivity of the human ear

\(^5\) Estimate from the Fatal Light Awareness Program (FLAP)
the wind turbines are too close together, one wind turbine may rob the wind from neighbouring wind turbines. On flat terrain, wind turbines are placed in rectangular arrays (see Figure 14 Rectilinear Array on Flat Terrain).

Wind farm designers specify the distance among wind turbines in Rotor Diameters (RD). Thus, a wind turbine with a rotor 100 meters in diameter that is 10 RD from another is separated by 1,000 meters (see Figure 15 Typical Wind Turbine Spacing). Wind turbines in Southwestern Ontario will be more evenly spaced than those in California wind farms because the winds in the province are more omnidirectional than those in mountain passes.

Spacing among wind turbines in an open array on flat terrain requires a maximum surface area of about 100 m² per 1 m of rotor swept area (10 RD by 10 RD spacing). Thus, for one wind turbine with a rotor 100 meters in diameter, the wind turbine will occupy 1 million m² or 1 square kilometre.

In practice, wind turbines are placed closer together to minimize the cost of road construction and cabling. Ontario landowners can expect spacing of 50 m² to 60 m² per 1 m of rotor diameter, or the equivalent of one-half square kilometre for every wind turbine 100 meters in rotor diameter.

Wind turbines in a rectangular or rectilinear array will be spaced closer together across the prevailing wind than in the direction of the wind. Wind turbines in Ontario will be much further apart than those in California’s mountain passes, typically 6 or more RD apart across the wind and 6 to 10 RD apart downwind.

Some land is required for service roads and for the foundations upon which the wind turbines stand. Some additional land may be needed for transformers and substations or for the power line that serves the wind turbines. Nevertheless, wind turbines use only a small fraction of the land area that they occupy, often less than 5% (see Figure 16 Wind Turbine Land Use).

Some land is required for staging equipment and assembling large components such as the rotor. Staging areas are often temporary, but it is good to define this and define how the land will be restored or the areas revegetated after construction is complete.

6.2 Building and Zoning Permits

Construction of wind turbines will require building permits. Additionally, as wind turbines are relatively new to Ontario they will often require amendments to local zoning and official plan by-laws. Wind turbines have been used in a wide variety of locations in North America and Europe. However, they may be prohibited in certain areas, such as wildlife preserves.
6.3 Electrical Conductors

All project power cables should be buried below plough depth (see Figure 17 Buried Electrical Conductors). Burying the power cables simplifies maintenance as the cables are less likely to be damaged by wind and ice. This also benefits the landowner as less land is taken out of cultivation than would be necessary for above ground utility poles. Additionally, it reduces the number of birds killed.

6.4 Roads

Large wind turbines will require construction of roads across farm fields (see Figure 18: Access Road: Unpaved, Paved, Hardened). Depending upon the season and the type of road, heavy construction equipment may damage municipal road surfaces. The wind developer often either repairs the roads that are damaged during construction or pays the local government to do so. In some parts of Ontario, construction is limited to half-load seasons to minimize road damage and disruption to area residents.

6.5 Interconnection

Wind turbines can be connected to the electricity grid in circuits through a disconnect switch with control equipment and transformer to either:

- **Distribution System**: Power lines less than 50 kilovolts (kV) which are controlled and operated by Local Distribution Companies (LDC) and Hydro One depending on the jurisdiction.

- **Transmission System**: Power lines greater than 50 kV which are controlled by the Independent Electricity System Operator (IESO) and operated by Hydro One. It is a lengthier and more complicated process to connect to the transmission system.

Large wind farms may require an accessory building or substation where a number of circuits are connected at a single tap point to the transmission or distribution system (see Figure 19: Single Interconnected Wind Turbine).

Transformers raise the voltage produced by the wind turbine to that required by the distribution lines. Transmission substations increase the voltage still further, to the corresponding voltage of the transmission line. Some wind turbines include the transformer in the nacelle at the top of the tower. Others place the transformer on the ground near the tower. Still others place the transformer inside the bottom of the tower (see Figure 20 on page 22).

6.6 Obstruction Lighting

Wind turbines of the size that will be typically used in Ontario require aviation obstruction marking. The flashing red or white lights atop the nacelle are intended to warn aircraft of the wind
turbine’s presence. The flashing lights are particularly noticeable at night, but may also designed to be visible during the day. The obstruction lighting requirements will be determined by Navigation Canada depending on the location of the nearest airport and common flight paths.

7. **Understanding Land Option Agreements**

The “option to lease” is often used during the preliminary phase of project development where the wind developer wants to install a wind-measuring mast or conduct other feasibility studies. For a small fee, usually a flat sum, the option to lease gives the wind developer the first right to develop the landowner’s property.

At the end of the option period the wind developer must either enter a long-term lease agreement with the landowner or release the landowner from further obligation. During the option period, the wind developer typically requires the exclusive right to lease the land from the landowner. Should the wind resource assessment prove there is a sufficient wind resource, the wind developer will exercise the option and enter into a long term lease agreement. This will occur if the developer has or is able to obtain a Power Purchase Agreement (PPA) to sell the electricity.

The following section provides an overview of some considerations before entering into a land option agreement. Land option agreements are legally binding documents and as such should be reviewed by your lawyer before signing. Some of the terms included in the land option may be negotiable, additional items may be added at the request of the landowner.

7.1 **Right of First Refusal**

The right of first refusal entitles the wind developer the right to match any other offer to lease the land from the landowner. Compensation for the right of first refusal may be factored into the option to lease. Alternatively, developers may propose a separate agreement for the right of first refusal, which itself has intrinsic value for which the landowner should be compensated.

7.2 **Wind Resource Measurement Options**

The lease or rent for the right to install a meteorological mast can be paid as an annual fee, a flat fee or as a fee for the amount of land taken out of cultivation. The option to use the land for this purpose is often one to three years.

The option allows the wind developer not only the right to install the equipment but also to return periodically to maintain the equipment and gather the data that’s being recorded. As part of the contract, the wind developer may ask the landowner for assistance in
retrieving the data from the electronic recorder. If so, compensation should be provided to the landowner.

If the option to lease for developing the wind resource is not exercised by the wind developer after measuring the wind, the data and any accompanying analysis may become the property of the landowner. If this is not the case, a right of first refusal provision may be negotiated by the landowner to purchase the data from the developer. The wind data is a valuable commodity and can be useful to the landowner and other interests.

7.3 Offering Multiple Lease Agreements

Don Bain, an American authority on wind rights, suggests that a landowner may want to consider multiple leases for their wind rights. The landowner could agree to enter into a long-term lease with the developer that is first able to meet certain project milestones. One such milestone could be a PPA or contract for the sale of the wind-generated electricity.

Landowners should be cautioned that land lease agreements are legally binding contracts between the landowner and developer and as such landowners cannot sign multiple lease agreements with multiple developers for the same piece of property.

7.4 Auctioning Wind Rights

Landowners who have received multiple offers from wind developers to lease their land may want to consider auctioning their wind rights to the developer with the best offer. Bids from developers should include more than just the lease payment to the owner. Additional items should include the length of contract, possible participation in the project by the landowner, and other non-price factors.

7.5 Landowner Wind Measurements

If the landowner has been approached by several wind developers seeking options to install a meteorological mast or lease land for a wind development, the landowner may want to consider installing the meteorological mast themselves, or hiring a firm to do so. The measurements, when done correctly and analyzed by a competent meteorologist, have intrinsic value.

Ontario meteorologists may be willing to contract the landowner to perform some of the services themselves, reducing the total cost of a wind measurement program. However, installing a 60-meter (197-foot) mast is not risk free and can be challenging even to the seasoned professional.

7.6 Length of Land Option Agreements

Land option agreements typically run between 1 to 5 years in length. Due to the modest financial payment to the landowner, a land option agreement that lasts longer than 5 years in length may be of limited benefit.
8. **Understanding Land Lease Agreements**

Land lease agreements are complex documents that may run with the land for 20 to 50 years. They should be carefully considered. The following are a number of topics that a landowner may want to consider in a land lease. This list is not exhaustive.

Importantly, the lease is just one part of a wind development project. While there is often an initial payment for signing a lease, the bulk of the revenue that a landowner can expect from a land lease occurs only after the project is built and electricity is sold on a continuing basis.

### 8.1 Length of Leases

Land lease agreements will be a minimum of 20 years in length, the life of the average wind turbine. Leases greater than 30 years in length will allow the developer to re-develop and re-power the site with newer turbines to replace the older machines. Some wind developers are proposing leases with terms that approach 50 years in length.\(^6\)

**Land Lease Extensions**

Land lease agreements often include an option to extend the lease beyond the initial term of the contract. Some leases in Ontario reserve all rights to extending the land lease agreement beyond the term of the contract to the wind developer. In the absence of financial escalator clauses, landowners should consider reserving the right to review the financial terms of the agreement at the time of the extension. Depending on the size of the project, the developer may request the review to be done collectively instead of individually with all landowners.

### 8.2 Power Purchase Agreements or Contracts

Developers require a satisfactory Power Purchase Agreement (PPA) to sell their electricity before a wind development is possible. Thus, a wind developer may offer an attractive land lease agreement, but without a valid contract with a creditworthy purchaser of the electricity, such as the Ontario Power Authority, the lease is of little monetary value to the landowner.

### 8.3 Restrictive Covenants

Any lease entered into by the landowner is with the land and will stay with the land, and as such may require inclusion on the landowner’s deed to the property. The wind developer’s right to use the landowner’s property under the lease may be contained in a restrictive covenant on the deed to the property.

The landowner should retain the ability to carry out normal activity on the property. If the landowner is required to temporarily interrupt activities then he or she should be adequately compensated.

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\(^6\) The Ontario Planning Act has provisions which cover land leases. A lease with a term greater than 21 years may be subject to different requirements than a shorter term lease. Therefore, many lease agreements are 21 years less a day, plus an option to extend the lease longer.

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*Figure 19: Single Interconnected Wind Turbine. Wind turbines can be installed in any number, from 1 to 1,000. Here a single wind turbines stands in a tilled field near Port Albert, Ontario. Note the faint trace of the buried conductors (power lines) from the wind turbine to the utility pole. (Photo by Paul Gipe)*
8.4 Development Costs
The wind developer assumes all costs associated with the wind development, its operation, and its maintenance, unless specified otherwise in the lease agreement.

8.5 Property or Other Taxes
The wind developer should be obligated to pay for any taxes that accrue from the wind development, whether an increase in property taxes or the instigation of other taxes due to the wind project.

8.6 Minimizing the Impact from Ancillary Structures
The landowner can request that the wind developer take all prudent steps to minimize the impact on the landowner and the existing use of the land for buried power lines, transformers, substations, roads, and so on. Some developers specify in the lease that they will do so. If not, this provision should be included at the landowners’ insistence.

8.7 Non-Disclosure Agreements
It is common practice among wind developers to demand non-disclosure agreements (NDA) with landowners. A landowner should weigh the privacy benefits that an NDA provides against the restrictions on information sharing that the NDA will create. This may be particularly true if the lease offered to one landowner differs from the lease offered to a neighbour.

There are legitimate reasons for a business owner to include an NDA. Developers want to prevent sensitive competitive information from getting into the hands of a competitive wind development company. For landowners such as farmers, who are accustomed to sharing information on crops, prices and markets with their neighbours, non-disclosure agreements may be uncomfortable. Landowners may find that sharing lease information with neighbours may be provided for by some wind developers.

8.8 Compensation for Landowners without Turbines
Some leases make no provision for payment to landowners that do not end up with a wind turbine on their property. Other leases will provide compensation for every landowner in the wind farm, whether or not a wind turbine ends up on their land.

8.9 Neighbouring Landowner Wind Rights
Landowners adjoining a wind project may have rights to compensation if, by development of the wind project, they are prohibited from developing the wind resource on their own land.

8.10 Ancillary Structures
Another means wind developers can use to compensate neighbouring landowners is to site structures ancillary to the wind project on neighbouring land. For example, a wind developer may offer to
place a road, transformer, substation, or control building on parcels neighbouring the wind turbines and compensate the neighbouring landowner directly for these structures.

8.11 Wind Rights
Some land leases permit landowners to install their own wind turbine(s). When permitted, leases often specify what size wind turbine is permitted and how far away it must be from the wind developer’s turbines.

8.12 Housekeeping Terms
Land leases should stipulate that the wind developer or operator is responsible for keeping the site clean from litter and debris. Further, the landowner should expect that any numbering of the wind turbines or signage be presented in a professional manner (see Figure 21: Numbering).

The landowner and developer should ensure that housekeeping terms are delineated in the lease agreement. Leases commonly require that all project trash, litter, or debris and all materials not needed immediately for the operation of the wind turbines should be removed from the landowners’ property and disposed of properly (see Figure 22: Litter Removal).

8.13 Hazardous Materials
The wind developer must be responsible for any spills of hazardous or toxic materials associated with the wind development, such as gearbox oil, transformer oil, fibreglass, electronics, and so on. The lease should state that no hazardous or toxic materials may be stored permanently on the landowners’ property and that such materials stored temporarily must be stored properly and safely and in accordance with Ontario laws.

8.14 Damages
Gates, Cattle Guards, Drainage Tiles
The developer pays for all gates, cattle guards, drainage tiles, surface drainage or other structures damaged during construction. Damage to drainage tiles may not appear during the first post-construction rainy season. The lease should provide the landowner sufficient time to determine if there is damage to surface or subsurface drainage due to the wind project.

Fencing
Damage to existing fencing caused by the wind developer should be repaired at the developer’s expense. If new fencing is required it should also be at the developer’s expense.

Fencing of the wind turbines themselves is not necessary and should be avoided if at all possible. Fencing of the turbines or other barriers

Figure 21: Numbering. Any signage or identification should be neat, tidy, and professional. (Photo by Paul Gipe)

Figure 22: Litter Removal. Leases should include provisions for insuring proper housekeeping such as removal of litter. (Photo by Paul Gipe)
to the wind turbines conveys the appearance of an industrial structure and not a rural use. However, some fencing may be required to protect wires and meteorological towers from disturbances by grazing animals.

**Crop Damage**

The lease should acknowledge that crops may be damaged during construction or occasionally during repair of the wind turbine or ancillary facilities and that the landowner will be compensated for any crops damaged.

**Fill Materials**

The lease should require that any gravel or other fill materials mined from the landowner’s site for the construction of access roads or used in the concrete for the foundation should be compensated for at rates that are agreed to by the landowner and the wind developer.

8.15 **Liability**

The wind developer should assume all liability for accidents, injuries or deaths during construction or operation of the wind turbines, including road accidents by contractors or operations personnel that occur on the landowner’s property.

The lease should ensure that the wind developer and operator take all reasonable measures to insure the safety of their employees, the safety of the landowner and their employees, and the safety of passers by or visitors (see Figure 23 Foundation Bolts: Capped & Uncapped).

8.16 **Indemnification for Environmental Impacts**

The landowner ought to require an indemnity provision in the lease so that the wind project developer indemnifies the landowner for any environmental impact that is a result of the wind development. This includes spills of hazardous materials, the killing or taking of any endangered or protected species of bird, bat, or other animal. In Ontario, a landowner may be subject to cleanup orders or prosecution under the Ontario Environmental Protection Act and may be subject to civil suits even if they are not responsible for the contamination.

8.17 **Access**

The wind developer will need access to the landowners’ property for construction, for operation, and for service of the wind turbines. The wind project operator may require access 24 hours per day (see Figure 24: Servicing the Wind Turbine).

The need for access and the times at which access may be required by the operator should be mentioned in the lease if this is a concern to the landowner. The landowner may also suggest points of entry to the property in the lease that minimizes impact on the landowner.
or neighbouring landowners. The lease could also suggest routes for access that minimize the use of arable land, such as along existing rights-of-way or along fence lines.

8.18 Decommissioning and Site Restoration

Eventually the wind project will come to an end. Land lease agreements should clearly identify who will be responsible for removing the wind turbines at the end of their useful lives or if they become inoperative. The lease should describe who determines when the wind turbines will be removed and who will pay for their removal.

As part of project decommissioning, the lease should state who will be responsible for ensuring that the site is restored and to what state. Provisions in the lease should be clear as to the removal, storage, and replacement of topsoil disturbed during construction. The landowner may also insist that the wind developer control noxious weeds in an agreed upon manner.

The lease should provide assurance to the landowner that the wind project developer will ensure that there are sufficient funds to eventually remove the wind turbines and restore the site to its pre-project use. Typically, the developer will either post a bond to do so or will provide some assurance in the lease that the funds required will be available at the end of the lease period.

Decommissioning may require removal of the wind turbines’ foundations to below grade level, preferably below plough depth. Similarly, decommissioning should require the proper disposal of oil filled components such as transformers and may or may not require the removal of all buried infrastructure such as buried electrical cable. Currently, there are no requirements for decommissioning in Ontario and so reasonable definition should be set out in the lease.

8.19 Interconnection with the Electrical Grid

All wind turbines erected on the property for commercial generation will need to connect to an electrical line. Depending on the size of the wind power facility and the voltage of the electrical line, transformers and/or substations may be required. The landowner will want to ensure that any transformer and/or substation is located in a mutually agreed upon location on the property.

The landowner should also ensure that all electrical conductors are buried underground below plough depth.

8.20 Arbitration of Disputes

There may be a need for an outside party to arbitrate disputes between the wind developer and the landowner. What determines the need for arbitration and how the arbiter is selected may also be included in the lease. This provides the parties with an opportunity to resolve the dispute without recourse to a lawsuit in court.
8.21 Landowners Rights & Responsibilities

If necessary, the landowner may be required to countersign applications for land use or building permits. The landowner guarantees the wind developer or its agent’s access to the land to perform functions related to the wind project. This doesn’t entitle the wind developer the right to hunt or otherwise use the property, unless so specified in the lease agreement.

The landowner’s right to install structures or other wind turbines that might interfere with the wind will be proscribed. This is usually spelled out in the lease. For example, the lease will specify how tall a building can be built within so many meters of the wind turbines or the size of the wind turbine that the landowner may install for their own use.

The landowner grants the wind developer rights and obligations under the lease and this obligation goes with the land to subsequent owners or heirs.


It is in the interests of both the landowner and the developer to ensure a fair remuneration for the use of the landowner’s land for the length of the contract. The method for determining the amount of compensation varies from lease to lease. Determining compensation for wind leases is probably the most confusing aspect of wind project development for landowners.

Landowners are likely to be presented with the following choices:

- One Time Lump Sum Payment
- Rent Payment per Year per Turbine or per MW
- Royalty Percentage of Gross Revenues with Minimum Payment

Typically, wind developers in Ontario offer minimum rent payments from $1,250 to $5,000 per turbine and royalties from 1.75% to 3% of gross revenues from the turbine or turbines on the landowner’s property. The amount that a developer offers to compensate the landowner will be dependent upon a number of factors, including:

- Annual Energy Output
- Power Purchase Agreement
- Value of property to project

These key factors will determine the amount of annual payment to the landowner. Regardless of other provisions in the land lease, landowners would be wise to keep these three factors in mind when negotiating compensation for leasing their land to a wind project developer.

7 Size of property, location and layout of property, and proximity to interconnection are some of the factors that contribute to some pieces of property being more valuable in a project to the developer than others.
9.1 One Time Lump Sum Payments
Most advisers discourage simple, one-time lump sum payments for land leases as this creates intergenerational conflicts between today’s landowner and their heirs. Heirs may wish to sell the land at some future date. However, a prospective purchaser will not receive any benefit if the wind rights were paid for with a lump sum. The heir may have to sell the property at a reduced value. On the other hand, ongoing royalty payments will increase the value of the land to both heirs and potential buyers.

Some developers may consider negotiating with the landowner a lump sum payment with the developer and invest the money into the project. The lump sum could be the net present value of all potential royalty payments that would have accrued to the owner over the life of the project. The owner would gain an ownership stake in the project and earn a financial return from the on-going operation of the project.

9.2 Rent Payment Per Turbine or Per MW per Year
Rent payments to landowners based on the number or size of the wind turbines can be confusing and should be carefully analyzed and compared to other methods of compensation. OSEA recommends that landowners avoid comparing payments per turbine or per megawatt of installed capacity. Lease rents described in $/MW can lead to landowners undervaluing their wind rights.

For example, consider the case of a proposed lease for $2,500/MW per year. To gauge the value of this payment relative to what other landowners receive, it is necessary to know exactly what wind turbine will be used. This information is often difficult to find in the lease. For a 1.5 MW turbine the landowner would receive $3,750 per turbine.

Though the payment per MW may be attractive because it offers certainty, it is likely less than what a landowner would realize on a percentage of gross revenue basis. OSEA recommends that landowners carefully compare rent payments per turbine with payments based on a percentage royalty payment. Generally, a royalty payment as a percentage of gross project revenues with a minimum payment to compensate for low wind years will provide a greater return to the landowner than a fixed payment.

Fixed payments per year, those not tied to a percentage of revenues, may increase with the general inflation rate, referred to as the Consumer Price Index, or CPI. Under the 2004 Ontario RFP #1, the escalator is CPI on 15% of the energy produced under the PPA.
Royalties as a percentage of the gross revenues generated by the wind turbines on the landowner's property usually provides the bulk of compensation to landowners from selling their wind rights.

Royalties in Ontario range from 1.75% to 3% due in part to the developing nature of the Ontario wind market (lack of local manufacturers, established facilities) and the subsidized cost of electricity paid by consumers. The range in more mature markets in the U.S. reaches to 6% and in Europe where wind farm developments have been a way of life for decades or longer, higher royalties are paid. This reflects the lower risk and lower infrastructure costs associated with more mature wind markets.

In the previous rent payment per MW example, the wind turbine described by the wind developer is a 1.5 MW model. There is only one such 1.5 MW model on the North American market. It uses a rotor 77 meters in diameter and sweeps approximately 4,500 m$^2$ of the wind stream. At a moderate wind site in Ontario it will generate about 750 kWh/m$^2$/yr or 3.5 million kWh per year. If the wind project is paid $0.08/kWh (the average tariff for projects in the province’s first renewable RFP), the wind turbine will earn $280,000 per year.

A landowner receiving 2.25% of gross revenue from the wind turbine will receive $6,300 out of the $280,000 per year earned by the wind turbine, or from the sale of electricity. In the rent payment example above, the landowner would only have received 1.3% of the sale price of electricity.

The contrast becomes much more significant as the price of energy increases. For example, should the price of energy increase to $0.12/kWh, the payment to the landowner would increase to $9,450 per turbine. However, the landowner receiving a rent payment per MW would still be receiving only $3,750. Expressed as a percentage of gross revenues, the landowner's payment has effectively decreased to 0.89% of gross revenues.

Royalties often include minimum payments based on the size and number of turbines and their projected production. For example, if royalties from the revenue generated falls below $3,500/MW, the landowner receives the minimum payment of $3,500/MW. However, it is important for landowners to understand that this is the minimum payment. It is generally advantageous for landowners to receive a percentage of revenues. This is typically greater than the minimum lease fee.

Royalty rates also may vary during the life of the lease. The royalties may be lower during the early years of the lease, when it is necessary for the developer to amortize the cost of the wind turbines and their infrastructure, and escalate in later years. Minimum royalty payments may also be indexed with inflation or otherwise include an escalator to compensate for inflation.
Royalties On All Revenue Sources

Wind projects in North American may sell more than electricity. They may also sell the ‘green attributes’ of generating the electricity. These attributes are commonly referred to as “Green Tags” in Ontario, though they are known by various names in other jurisdictions.8 For developers awarded contracts with the provincial government through the Ontario RFP these attributes and all other associated products became the property of the provincial government.

However, some developers may sign a PPA with an entity other than the provincial government that will not include these attributes or other associated products. These additional revenue sources can be substantial. There is currently no market for these certificates in the NAFTA trade zone; however, this may change in the next decade. If applicable, landowners should ensure that their royalty payments include the sale of any attributes or associated products from the wind power facility.

Escalators

Some lease agreements increase the royalty percentage paid to the landowner in years 11 through 20 and yet again in years 21 through 30 (see Appendix C Royalties & Land Rents for Single Wind Turbines & Wind Power Plants as Percent of Gross Revenue). There is little information publicly available on the royalties paid in the later years of wind leases. In Ontario royalties in the second term of the lease may range from 3% to 4%.

9.4 Royalty Revenue Calculator

OSEA has created a simple spreadsheet that calculates the royalty revenue a landowner would receive when leasing their land to a wind project developer. The calculator estimates the amount of electricity typical wind turbines would produce given a specific wind resource.

The revenue calculator then accounts for the key factors affecting compensation to a landowner: the amount of electricity that would be generated, the tariff paid for the electricity, and the royalty rate (see Appendix C Wind Energy Royalty Revenue Calculator).

The calculator also has the ability to account for different royalty rates in each of three decades that the lease would likely be in effect. Using this information, the calculator estimates annual revenues the landowner would receive from a lease and calculates the Net Present Value of this revenue stream over the life of the project.

9.5 Net Present Value

Wind turbines are designed to last for at least twenty years. There are wind turbines in Denmark, Germany, and California that have been in service for more than twenty years and are still in operation. Because wind turbines are such long-lived investments, landown-
ers are advised to look at the revenues they generate over the long term. To do so the landowner must not only look at the revenues generated today, but estimate the revenues that will be generated in future years, taking into account the future value of money.

One way this is done is to examine future earnings in today’s dollars by including the effects of inflation and the interest that might be earned on alternative investments. This is called the Net Present Value (see Appendix B Sample Revenues from Royalty Payments on a Land Lease).

10. Final Notes

Wind power is a mature, reliable and sophisticated technology. In Ontario, landowners are faced with several options to developing wind power on their property. The option that is right for you will be dependent on the amount of risk you can tolerate, the amount of personal and financial reward you desire to earn, and the resources you have.

10.1 Pressure to Sign

Landowners should never feel pressure to sign a land lease. In many cases, the landowner has been on the land for many years and will likely be on the land for years to come. The landowner, and often their heirs, will have to live with their decision for decades. The opportunity to develop a specific project with a specific developer may be time sensitive, but the wind resource will be there tomorrow and another development opportunity may present itself in the future.

10.2 Background Check

Always check the background of the company offering the wind development lease. Don’t rely on the company’s in-house web site or glossy brochures. Wind energy is a multibillion dollar industry in North America. There are trade associations in Canada such as the Canadian Wind Energy Association (CanWEA), numerous consultants, and several annual conferences that deal with the subject of wind energy. There are consultants who specialize in land lease agreements.

If a company claims that they have built wind projects elsewhere, ask for references—and contact them. Check out the viability of the wind company’s plans. Do they have the ability and credibility to carry out the proposed project? Do they have a power purchase agreement in place? Any homework you do is in your own best interests.

10.3 Too Good to Be True?

As in every other aspect of life, if the deal is “too good to be true,” it probably is.
10.4 Land Lease Speculation
A signed lease on a windy parcel has intrinsic value. It is worth something and the lessee can sell the lease to another party if not prohibited from doing so in the lease agreement.

There are reasonable business reasons for legitimate wind developers to have provisions allowing the sale of the lease to another party. However, it is possible that provisions in some leases could simply be used for speculative purposes to “flip” the lease to another party, without any real intention on the initial company’s part to actually build a wind development in the first place.

It’s not uncommon for a landowner to negotiate in good faith with a wind developer and sign a lease with the local agent only to find that the wind developer has sold the lease to another party. The landowner now must deal with a new company, a new set of people, none of whom may have been party to unwritten understandings between the landowner and the original local agent for the next two decades—at least.

If a landowner wants to avoid speculation in their lease agreement, they must include a provision prohibiting such a quick transfer or “flipping” of the development rights.

10.5 Legal Advice
As in all land transactions, the landowner should consult trusted legal counsel before signing any option, or lease agreement.

10.6 Financial Advice
The landowner should consult a competent financial adviser about how the payments for the land lease agreement and royalties will affect the income tax status of the landowner. Taxes on the sale of the electricity should be borne by the wind project operator.

10.7 Final Considerations
By signing a lease with a developer, the landowner should be aware that the lease may preclude the development of additional buildings and/or structures on the property. Legal counsel can advise the landowner what impact the lease will have on the property.

A landowner should also consider any impact that may be caused to the property value by having wind turbines. There are no known studies of the impact of wind facilities on property values in Ontario. In the U.K., the Royal Institute of Chartered Surveyors (RICS) released a study in 2005 that found 63% of professional property value assessors felt wind turbines had no negative impact on agricultural property value.9

Finally, as with all business transactions, there is the risk that one party may become financially unviable. While the situation is unlikely, it is to the benefit of the landowner to ensure the lease agreement satisfactorily addresses their concerns in the case of bankruptcy.

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9 www.rics.org ‘Wind Farms Final Report.pdf’
### Appendix A

#### Standard (Nominal) Power Rating & Swept Area

Note that in the following table the rotor diameter is used to calculate the area swept by the rotor and this is then used to estimate the amount of electricity that the wind turbine will produce at a site with a 6 m/s average wind speed at hub height. This is equivalent to an annual specific yield of 770 kWh/m²/yr. The power rating is an approximation only used to provide reference. It is not used to calculate the electricity that could be produced.

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<th>Nominal Generation @ 6 m/s Hub Height Avg. Wind Speed (Avg. Annual Yield of 770 kWh/m²/yr)</th>
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<td><strong>Rotor Diameter (m)</strong></td>
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<td><strong>Nominal Power kW</strong></td>
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<tr>
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<td>11,300</td>
<td>4,000</td>
</tr>
</tbody>
</table>
### Appendix B

Sample Revenues from Royalty Payments on a Land Lease

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Payment/ kWh</th>
<th>Portion of Payment Indexed with Inflation</th>
<th>Discount Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$0.08</td>
<td>3%</td>
<td>6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Payment/ kWh</th>
<th>Royalty</th>
<th>Revenue</th>
<th>Total Revenues</th>
<th>Net Present Value of Contract Revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$0.08</td>
<td>0.02</td>
<td>$6,400</td>
<td>$6,400</td>
<td>$6,000</td>
</tr>
<tr>
<td>2</td>
<td>$0.08</td>
<td>0.02</td>
<td>$6,400</td>
<td>$12,800</td>
<td>$11,700</td>
</tr>
<tr>
<td>3</td>
<td>$0.08</td>
<td>0.02</td>
<td>$6,500</td>
<td>$19,300</td>
<td>$17,200</td>
</tr>
<tr>
<td>4</td>
<td>$0.08</td>
<td>0.02</td>
<td>$6,500</td>
<td>$25,800</td>
<td>$22,300</td>
</tr>
<tr>
<td>5</td>
<td>$0.08</td>
<td>0.02</td>
<td>$6,500</td>
<td>$32,300</td>
<td>$27,200</td>
</tr>
<tr>
<td>6</td>
<td>$0.08</td>
<td>0.02</td>
<td>$6,500</td>
<td>$38,800</td>
<td>$31,800</td>
</tr>
<tr>
<td>7</td>
<td>$0.08</td>
<td>0.02</td>
<td>$6,600</td>
<td>$45,400</td>
<td>$36,200</td>
</tr>
<tr>
<td>8</td>
<td>$0.08</td>
<td>0.02</td>
<td>$6,600</td>
<td>$52,000</td>
<td>$40,300</td>
</tr>
<tr>
<td>9</td>
<td>$0.08</td>
<td>0.02</td>
<td>$6,600</td>
<td>$58,600</td>
<td>$44,200</td>
</tr>
<tr>
<td>10</td>
<td>$0.08</td>
<td>0.02</td>
<td>$6,700</td>
<td>$65,300</td>
<td>$48,000</td>
</tr>
<tr>
<td>11</td>
<td>$0.08</td>
<td>0.03</td>
<td>$10,000</td>
<td>$75,300</td>
<td>$53,200</td>
</tr>
<tr>
<td>12</td>
<td>$0.08</td>
<td>0.03</td>
<td>$10,100</td>
<td>$85,400</td>
<td>$58,200</td>
</tr>
<tr>
<td>13</td>
<td>$0.08</td>
<td>0.03</td>
<td>$10,100</td>
<td>$95,500</td>
<td>$63,000</td>
</tr>
<tr>
<td>14</td>
<td>$0.09</td>
<td>0.03</td>
<td>$10,200</td>
<td>$105,700</td>
<td>$67,500</td>
</tr>
<tr>
<td>15</td>
<td>$0.09</td>
<td>0.03</td>
<td>$10,200</td>
<td>$115,900</td>
<td>$71,700</td>
</tr>
<tr>
<td>16</td>
<td>$0.09</td>
<td>0.03</td>
<td>$10,300</td>
<td>$126,200</td>
<td>$75,800</td>
</tr>
<tr>
<td>17</td>
<td>$0.09</td>
<td>0.03</td>
<td>$10,300</td>
<td>$136,500</td>
<td>$79,600</td>
</tr>
<tr>
<td>18</td>
<td>$0.09</td>
<td>0.03</td>
<td>$10,400</td>
<td>$146,900</td>
<td>$83,300</td>
</tr>
<tr>
<td>19</td>
<td>$0.09</td>
<td>0.03</td>
<td>$10,400</td>
<td>$157,300</td>
<td>$86,700</td>
</tr>
<tr>
<td>20</td>
<td>$0.09</td>
<td>0.03</td>
<td>$10,500</td>
<td>$167,800</td>
<td>$90,000</td>
</tr>
</tbody>
</table>
### Appendix C

Wind Energy Royalty Revenue Calculator

<table>
<thead>
<tr>
<th>Energy Generation Estimation</th>
<th>Enter Values</th>
<th>Units</th>
<th>Results</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter Hub Height Average Annual Wind Speed in m/s in whole and half values, eg. 7.5</td>
<td>6</td>
<td>m/s</td>
<td>770</td>
<td>Specific Yield in kWh/m²/yr</td>
</tr>
<tr>
<td>Enter Rotor Diameter in meters (see Typical Turbine for possible values)</td>
<td>82</td>
<td>m</td>
<td>5,300</td>
<td>Swept Area in m²</td>
</tr>
<tr>
<td>Annual Energy Output</td>
<td></td>
<td></td>
<td>4,081,000</td>
<td>kWh/yr/unit</td>
</tr>
<tr>
<td>Enter Availability for Operation (Typical values from 90% to 98%)</td>
<td>98</td>
<td>%</td>
<td>3,999,000</td>
<td>kWh/yr/unit</td>
</tr>
<tr>
<td>Enter Array Losses (for single turbine use 0%, for large arrays use 5% to 10%)</td>
<td>0</td>
<td>%</td>
<td>3,999,000</td>
<td>kWh/yr/unit</td>
</tr>
<tr>
<td>Typical Rated Capacity</td>
<td></td>
<td></td>
<td>1,800</td>
<td>Nominal kW</td>
</tr>
<tr>
<td>Enter Number of Units</td>
<td>1</td>
<td></td>
<td>3,999,000</td>
<td>Total kWh/yr</td>
</tr>
<tr>
<td>Total Installed Capacity</td>
<td></td>
<td></td>
<td>1.8</td>
<td>Nominal MW</td>
</tr>
<tr>
<td>Land-Owner Revenue Estimation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter Discount Rate (Average Weighted Cost of Capital) from 5% to 12%</td>
<td>8</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter Royalty Rate for Years 1-10 (see Royalties and Land Rents for typical values)</td>
<td>2</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter Royalty Rate for Years 11-20 (see Royalties and Land Rents for typical values)</td>
<td>3</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter Royalty Rate for Years 21-30 (see Royalties and Land Rents for typical values)</td>
<td>4</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter Purchase Power Payment for Year 1 in $/kWh (Ontario RFP #1, ~$0.08/kWh)</td>
<td>0.08</td>
<td>$/kWh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter Inflation Rate (Typical values from 3% to 5%)</td>
<td>3</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter Portion of Purchase Power Payment Indexed with Inflation (15% to 100%)</td>
<td>15</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enter Term of Contract (Typical values 20 years to 30 years)</td>
<td>20</td>
<td>yr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Revenues</td>
<td></td>
<td>$167,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Present Value of Revenues Over Life of Contract</td>
<td></td>
<td>$90,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
European landowners often form a land pool or association when approached by wind developers. For example, if a landowner’s portion represented 50% of the land pool, they would receive 50% of the land lease payment even if they had no wind turbines installed on their parcels. Landowners with wind turbines or other structures receive payments in addition to the land lease payment.

**Source:**
Appendix E

Our many thanks to the reviewers who helped in the making of this guide:

Ken Baigent, Mark Bell, Paula Boutis, Alisha Chauhan, Steve Clarke, Ted Cowan, Liz Cussans, Deb Doncaster, Jason Edworthy, Doug Finlay, Doug Fyfe, Jen Heneberry, Dave MacLeod, Claude Mindorff, Steve Sottile, David Timm, Bob Younkers and Melinda Zytaruk

Additional Sources of Information

It’s wise for landowners to do their homework first before signing a lease. There is a lot of information on the internet. Some links are provided here. There are books on wind energy that explain how wind turbines work and how much electricity they will generate. Both the Ontario Federation of Agriculture and the National Farmers Union have reviewed wind development leases in the province. They may offer guidance to members.

Links to Documents on the Internet


News Groups or Lists
Windustry’s Wind Farmers Network sponsors a list discussing land leases. The topic is listed as “Have you been approached by a wind developer?”

Books on Wind Energy


Spreadsheets
“Wind Energy Royalty Revenue Calculator” is a multi-tab spreadsheet for calculating the potential revenue from royalties on wind energy land leases. The spreadsheet is available for downloading from the OSEA web site at www.ontario-sea.org/FarMWind/WindEnergyRoyaltyRevenueCalculator.xls.

Contacts
For information regarding the Ministry of Natural Resources online wind map for Ontario contact:

Mike Belcher
Manager, Sustainable Review Strategy
Land Management Section
Ministry of Natural Resources
Robinson Pl South Tower, 5th Floor S., 300 Water St
PO Box 7000, Peterborough, ON K9J 8M5
Phone: 705-755-1279
Email: Mike.Belcher@mnr.gov.on.ca

For more information regarding net metering in Ontario:
Hydro One Net Metering Information Line
Call 1-866-280-7712 for more information.

Existing net metering agreement form can be found at: