STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

Petition of BNE Energy Inc. for a Declaratory Ruling for the Location, Construction and Operation of a 3.2 MW Wind Renewable Generating Project on New Haven Road in Prospect, Connecticut	**Docket/Petition No. 980** **March 8, 2011**

<u>Prefiled Testimony of John Hurley</u>

1. Please state your name and address for the record.

My name is John Hurley. I reside at 4 George Street, Prospect, CT with my wife and daughter.

2. How long have you lived at this address?

Twenty years.

3. How far is your home from the proposed industrial wind turbine site and how long have you lived there?

My home is approximately 1,400 feet from both the north and south turbines. I have lived here for 20 years. My home is paid for.

4. What concerns do you have relating to the proximity of the proposed wind turbines to your home?

I am very concerned about the siting of the two 492 foot high commercial wind turbines next to our home for many reasons. I am concerned for my family's health and safety, our quality of life and the adverse impact on the value of our property. I believe my property will be worth virtually nothing at all if the approval to put up the two turbines goes through. I will not be able to sell my home and will be forced to live with two, 492 foot high turbines very close to my home. In addition, I am particularly concerned that the construction on the proposed site will disrupt the contamination on the U.S. Cap and Jacket Superfund site on New Haven Road. I am also concerned about the adverse impact on pets and wildlife and most importantly, all my neighbors, the people who will be living next to the turbines every day and night. The turbines are proposed to be just across the street from my home. There will be no escaping these permanent and giant structures.

4. What do you know about the Superfund site located at 214 New Haven Road in Prospect?

Well, it's a very uncomfortable subject for all of us who live up the hill. The site is directly across the street from my house. It is well-documented that the soil and bedrock at that site is contaminated with solvents and volatile organic compounds that were used to degrease metal components. The solvents have leached into some of my neighbors' drinking wells. I believe that they are listed as either carcinogens or possible carcinogens. The contamination did not reach my property but I am concerned that construction at 178 New Haven Road, whether it's blasting, drilling, digging or clearing trees, will disturb the contamination on the Superfund site and cause it to migrate into my drinking well. I am also concerned that BNE will disturb any contamination that may have already migrated to 178 New Haven Road, the site of proposed wind turbines. There has been no clear answer of exactly where the contamination may have traveled to.

5. Do you have an understanding of how the wind turbines are anchored to the ground?

I believe there are three methods. The first is a patented tube design that is 18-20 feet in diameter and 40 feet deep. The hole is either excavated or blasted. The second is a gravity foundation that is shaped like an upside down mushroom. This method requires the most concrete to build and is designed for poorly consolidated soils. The turbines are then anchored onto these concrete pads. The third is a rock-anchored foundation, which requires a series of anchors to be drilled into the base stone and then tied to a foundation cap on the surface.

6. What do you base this on?

I conducted internet research using various search engines. I reviewed the website of a construction services firm located in Los Angeles, California. In particular, I read about turbine foundations and structural engineering: http://advanceddevelopmentsite.com/wind-turbine.php and http://advanceddevelopmentsite.com/structural-engineering.php. Copies are attached hereto as Exhibit A. In addition, I read an overview of wind turbine technology prepared by Global Energy Concepts. A copy is attached hereto as Exhibit B (see pages 14-15).

7. Have you read BNE's petition in this matter?

Yes.

8. Did you read anything about how the two turbines will be anchored to the earth?

I did not read anything about this in my review of the petition or site plans.

9. In addition to the Superfund site, please identify and describe all of your concerns relating to BNE's proposed wind project in Prospect.

Shadow Flicker:

I believe that the wind turbines will produce a dramatic shadow flicker effect that will be very distracting to us all who are directly in their shadows. I believe the shadow flicker report has my home listed as one of the most affected homes of the shadow flicker. Each turbine would be west of my house and yard. I anticipate that this will frustrate my enjoyment and use of the yard, pool and garden. I believe that the shadow flicker will occur at a time when we are all home in the spring and summer months eating dinner or enjoying our yard. I cannot believe that this foreseen torture will be allowed to occur and that the only solution is to purchase blinds and stay inside.

Noise:

Being that we will live so close to the turbines, I truly believe that we will be subjected to constant noise; a noise as long and as loud as the wind dictates. This is unacceptable. I have four sleep disorders that have been diagnosed at the Waterbury Hospital sleep lab. According to my doctor, I have all sleep disorders that are known. In addition, I have severe tinnitus in my right ear. It has been documented that the loud jet-like sound emitted from the turbines irritate and worsen the aforementioned health issues that I am presently dealing with. I currently take medication to treat my sleep disorders and tinnitus with minimal success. I am very concerned about the effects the relentless industrial noise, being generated from the turbines, will have on me and my family, including our dog, Morgan. I have read that wildlife leave the areas where industrial wind turbines have been erected. The infrasonic noise is torture to them.

Property Value:

I am concerned that the proximity of my home to the 492-foot wind turbines will have an adverse impact on the value of my property. It will be impossible to sell.

Ice throw:

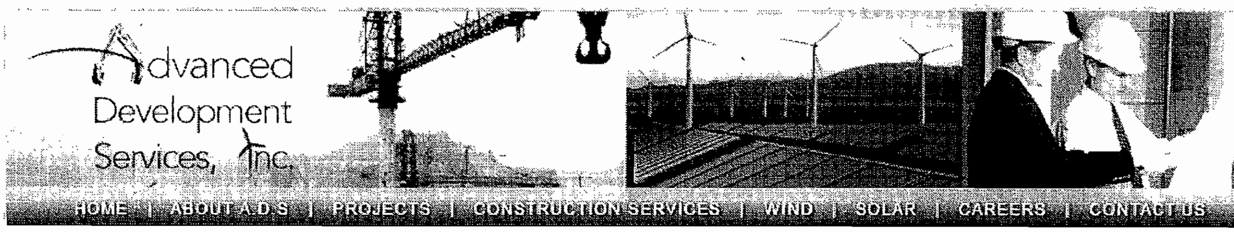
It is a fact that wind turbines can and will occasionally throw off chunks and sheets of ice into the air. During my internet research, I found a GE document that confirms this fact. The document is titled "Ice Shedding and Ice Throw - Risk and Mitigation." A "pdf" of the document can be found here: www.gepower.com/prod_serv/products/tech_docs/en/downloads/ger4262.pdf. I am concerned that there is a chance my house, my family or motorists traveling on Route 69, will be hit by ice thrown from the turbine blades.

10. Is there anything else that you would like for the Siting Council to consider?

Yes. I just turned 50 years old. One of the striking milestones of reaching 50 is that my home is paid for. I have a line of credit on what used to be my mortgage but the home is paid off. This happened the old fashioned way - through hard work and converting to a fifteen year mortgage. Our family knowingly compressed payments, which meant stressed monthly budgets, but it has been well worth it. I thought I finally had the home that I always wanted in a great town.

These last few months have been very hard on all of us. We've lost sleep, suffered anxiety, and had the fear of the unknown, the possibility of essentially losing our home if BNE's petition is approved. My future is now in the hands of the Siting Council. All that I can do is hope and pray that our dream of home ownership, and all that goes with it, is not destroyed by two 492-foot wind turbines sited so unreasonably close to our homes.

EXHIBIT A



We offer the following services:

- **Met Tower Installation**
- **Turbine Foundations**
- **Structural Engineering**
- **Construction Management**
- **Design & Layout**
- **Access Roads Grading**
- **Permitting**

Wind Turbine Foundations

Most foundations installed by Advanced Development Services, Inc. utilize the **tube-style design patented by Patrick and Henderson, Inc.**

Due to its tensionless feature and low cost, of the major designs available today, P&H designs have become the prefered foundation type.

For more information on P&H foundation systems, please refer to our page entitled "Structural Engineering."

For soil conditions less than ideal for a P&H design system, alternative foundation types are available. These may include:

<u>Gravity Foundation.</u>

The gravity foundation, shaped like an upside-down mushroom, is designed to be installed in poorly consolidated soils. The foundation system has the effect of holding the wind turbine upright through sheer weight and leverage. The design is used widely, but requires the most concrete to build, and thus may not be the most cost effective.

<u>Rock-Anchored Foundation.</u>

If a wind turbine is sited on solid, non-fracturing rock, a series of anchors can be drilled into the base stone and then tied to a foundation cap on the surface. This "rock-anchored" type of foundation is less expensive to build than a gravity foundation, but can only be used where the rock formations are close to the surface and their geological structure will hold anchors securely over time.

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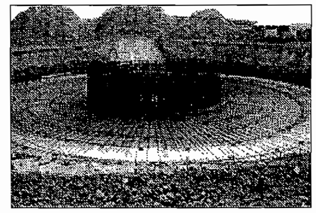
Structural Engineering



There are three general types of foundations used to securely anchor wind turbines to the earth. These are described as: the **Tube-Style** (P&H), **Gravity** (mushroom), and **Rock-Anchored**.

Based on initial geotechnical borings on your project land, our Civil Engineers choose foundation designs that hold fast in strong winds, are low cost to build, and have low construction risk (proprietary).

However, with permit, many borings must be performed in order to determine the composition wind farm's soil, rock, and sub-surface environment. This is necessary for proper construction and to comply with post-permitting regulatory requirements. Final foundation design cannot be determined until these borings and further soil analyses have been completed.

Tube-Style (P&H) Foundation.

The tube-style foundation uses a patented tube design by Patrick and Henderson, Inc., that reduces overall impact and costs. The design requires only an 18-20' diameter, 40' deep hole, which is either excavated or blasted to the required depth. The hole is then lined with two concentric steel tubes; bedrock anchors and steel reinforcing are installed; and electrical and communications lines are brought in. The ring of the "doughnut" is then filled with concrete, and the center back-filled with earth. Pouring a concrete cap on top completes the foundation.

Advance Development Services, Inc. is a licensed contractor and P&H foundations installer. We work closely with the Engineering Office of Patrick and Henderson, Bakersfied, CA, on all phases of the development; starting from soil and geo work, through design, permitting and inspections.

After building access roads and clearing areas for turbine pads, test holes will be drilled around the optimal perimeter for each foundation tube, to confirm foundation type and the depth to bedrock. If soil analysis does not support the P&H foundation, Advanced Development Services, Inc. will choose one of the other two alternatives described on this website.

Gravity Foundation.

The gravity foundation, shaped like an upside-down mushroom, is designed to be installed in poorly consolidated soils. The foundation system has the effect of holding the wind turbine upright through sheer weight and leverage. The design is used widely, but requires the most concrete to build, and thus may not be the most cost effective

Rock-Anchored Foundation.

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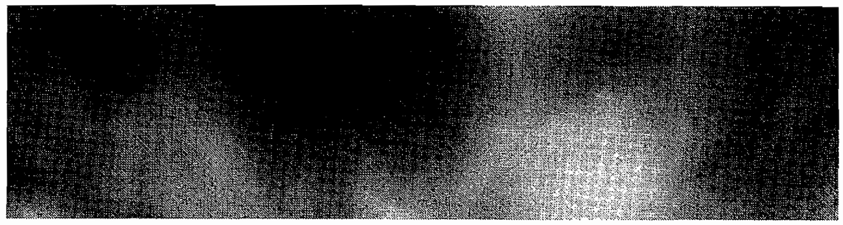
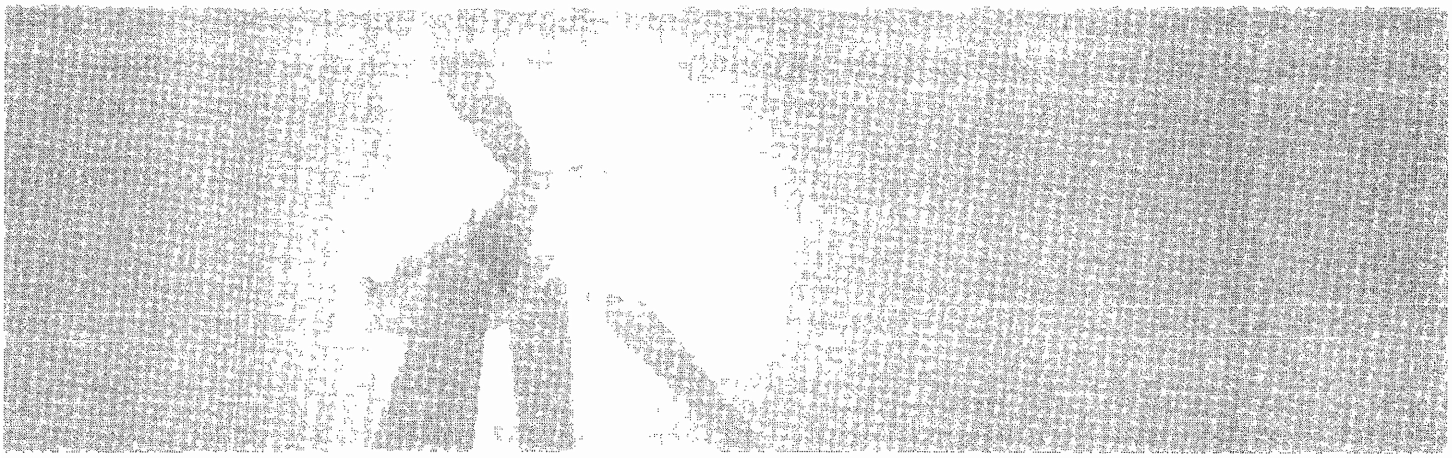
EXHIBIT B





WIND TURBINE TECHNOLOGY

Overview

Available at:
www.powernaturally.org
October 2005
NYS Energy Research & Development Authority
17 Columbia Circle
Albany, NY 12203-6399
www.nyserda.org

Prepared by:
Global Energy Concepts

This document is one of a series of reports and guides that are all part of the NYSERDA Wind Energy Tool Kit. Interested parties can find all the components of the kit at: www.powernaturally.org. All sections are free and downloadable, and we encourage their production in hard copy for distribution to interested parties, for use in public meetings on wind, etc.

Any questions about the tool kit, its use and availability should be directed to: Vicki Colello; vac@nyserda.org; 518-862-1090, ext. 3273.

In addition, other reports and information about Wind Energy can be found at www.powernaturally.org in the on-line library under "Large Wind."

NOTICE

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Wind Turbine Technology Overview

Turbine Sizes

Wind generation equipment is categorized into three general classifications:

- Utility-Scale – Corresponds to large turbines (900 kW to 2 MW per turbine) intended to generate bulk energy for sale in power markets. They are typically installed in large arrays or 'wind energy projects,' but can also be installed in small quantities on distribution lines, otherwise known as distributed generation. Utility-scale development is the most common form of wind energy development in the U.S.
- Industrial-Scale – Corresponds to medium sized turbines (50 kW to 250 kW) intended for remote grid production, often in conjunction with diesel generation or load-side generation (on the customer's side of the meter) to reduce consumption of higher cost grid power and possibly to even reduce peak loads. Direct sale of energy to the local utility may or may not be allowed under state law or utility regulations.
- Residential-Scale – Corresponds to micro- and small-scale turbines (400 watts to 50 kW) intended for remote power, battery charging, or net metering type generation. The small turbines can be used in conjunction with solar photovoltaics, batteries, and inverters to provide constant power at remote locations where installation of a distribution line is not possible or is more expensive.

Discussion of utility-scale turbines is the primary focus of the NYSERDA Wind Energy Toolkit; however, information about industrial-scale and residential-scale turbines is also provided in this paper for use in planning activities.

The Technology

In North America, all commercially available, utility-scale wind turbines from established turbine manufacturers utilize the 'Danish concept' turbine configuration. This configuration uses a horizontal axis, three-bladed rotor, an upwind orientation, and an active yaw system to keep the rotor oriented into the wind. The drive train consists of a low-speed shaft connecting the rotor to the gearbox, a 2- or 3-stage speed-increasing gearbox, and a high-speed shaft connecting the gearbox to the generator. Generators are typically asynchronous, induction, and operate at 550-690 V (AC). Some turbines are equipped with an additional small generator to improve production in low wind speeds. The second generator can be separate or integrated into the main generator. Each turbine for utility-scale applications is equipped with a transformer to step up the voltage to the on-site collection system voltage. The on-site collection system typically is operated at medium voltages of 25 to 35 kV. Figure 1 shows the major turbine components for a wind turbine.

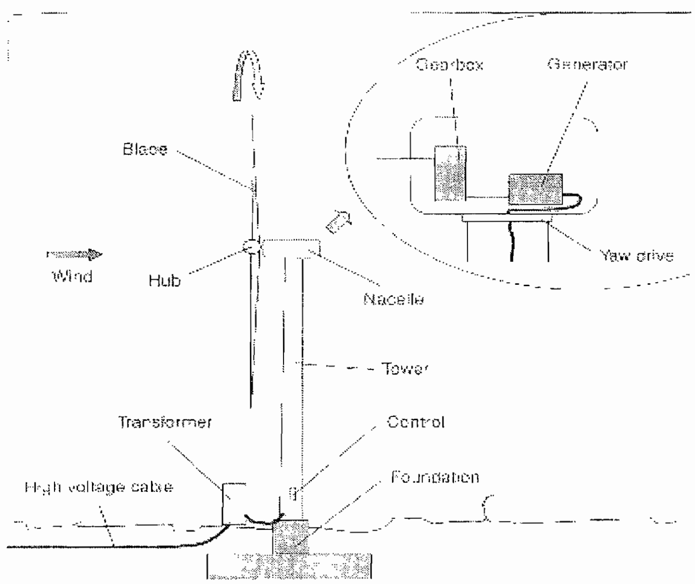

Figure 1. Major Turbine Components

As shown in Figure 2, power production from a wind turbine is a function of wind speed. The relationship between wind speed and power is defined by a power curve, which is unique to each turbine model and, in some cases, unique to site-specific settings. In general, most wind turbines begin to produce power at wind speeds of about 4 m/s (9 mph), achieve rated power at approximately 13 m/s (29 mph), and stop power production at 25 m/s (56 mph). Variability in the wind resource results in the turbine operating at continually changing power levels. At good wind energy sites, this variability results in the turbine operating at approximately 35% of its total possible capacity when averaged over a year.

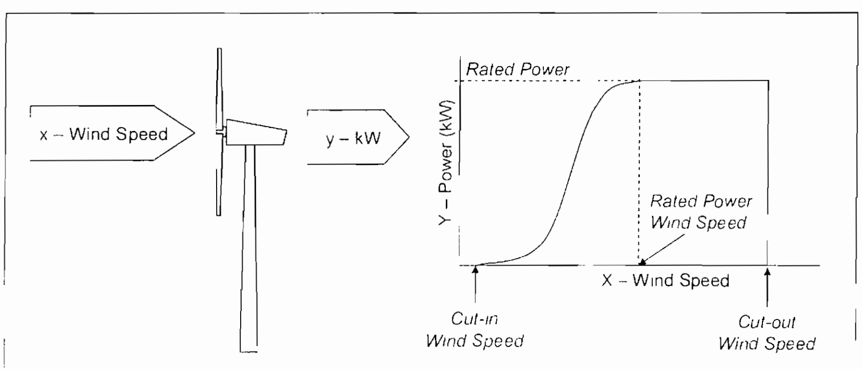

Figure 2. Relationship of Wind Speed to Power Production

Ratings and Rotor Size

The rotor diameters and rated capacities of wind turbines have continually increased in the past 10 years, driven by technology improvements, refined design tools, and the need to improve energy capture and reduce the cost of energy. For comparison, the average turbine rating for turbines installed in the U.S. in 2001 was 908 kW, while turbines installed in 2003 had an average capacity of 1,374 kW. In 2005, turbines with rated capacities of 1.5 MW to 1.8 MW present the vast majority of the turbines sizes installed in North America. Figure 3 compares the height of a large wind turbine with other tall structures.

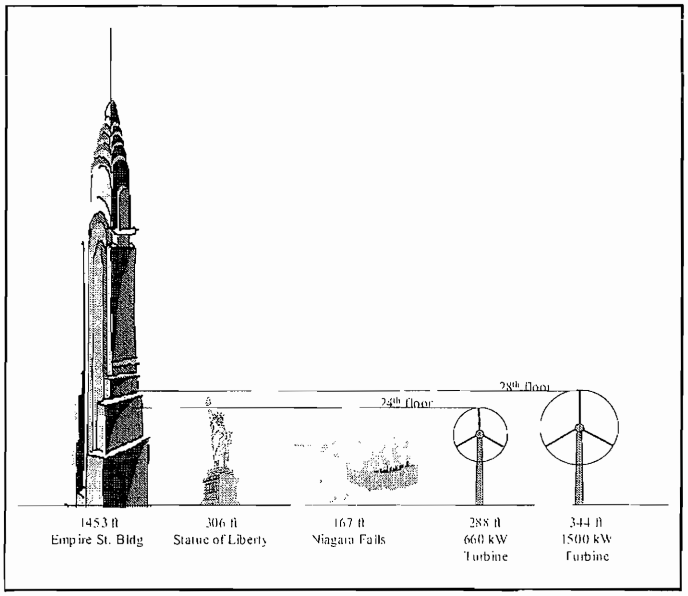

Figure 3. Large Wind Turbine Height Comparisons

Hub and Maximum Tip Heights

As the rotor diameters and rated capacities have increased, so has the hub height of the wind turbines. There is no standard hub height or ratio of hub height to rotor diameter. Wind resource characteristics, terrain, turbine size, availability of cranes, and visual impacts are but a few critical items that are used to determine the most optimum hub height for a given project. Current utility-scale wind turbines can employ hub heights that range from 50 m (164 ft) to 80 m (262 ft). Common hub heights used during 2004-2005 fall in the range of 65 m (213 ft) to 80 m (236 ft).

Maximum tip heights (the highest point of the rotor) depend on the hub height and rotor diameter. Table 1 provides an example of the range of tip heights common in 2003. As of

May 2005, the tallest wind turbine in the U.S. utilizes an 80-m (262-ft) hub height and a 82-m (279-ft) rotor diameter with a resulting maximum tip height of 121 m (397 ft). Figure 4 identifies these key physical features of a wind turbine.

Table 1. Common Dimensions for Utility-Scale Wind Turbines

Dimension	Multi-Megawatt Turbines	Sub-Megawatt Turbines
Hub Height	80 m (230 ft)	65 m (213 ft)
Rotor Diameter	77 m (231 ft)	7 m (154 ft)
Maximum Tip Height	118.5 m (389 ft)	88.5 m (290 ft)

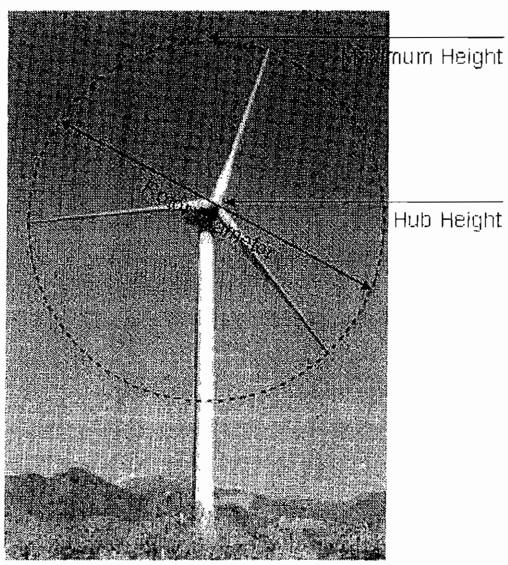

Figure 4. Wind Turbine Features

Optimum turbine size is heavily dependent on site-specific conditions. In general, turbine hub heights are approximately 1 to 1.4 times the rotor diameter. Project analysis conducted to identify the optimum turbine equipment typically results in a compromise between rotor size, hub height, energy production, component handling logistics, and cost.

Specific Rating

The ratio of a turbine's rotor swept area to the rating of the turbine is known as the specific rating. No 'best' relationship between rotor diameter and generator rating exists. Designers of modern turbines appear to have settled on a range of specific ratings from 0.32 to 0.47 kW/m^2, as this range presents the best compromise between energy capture, component loading, and costs. Turbines at sites with lower wind speeds (such as 7.0 to 7.5 m/s annual average at hub height) tend to have larger rotors and lower specific ratings to improve energy capture. Turbines at high-wind-speed sites (exceeding 9 m/s) tend to have smaller rotors and higher specific ratings. The smaller rotor helps to reduce loads on components and thus improves reliability in these aggressive wind sites.

Control Scheme

The control scheme employed to operate the turbine to produce grid-quality electricity varies among turbine manufacturers. No one control scheme is the 'best.' Each has advantages and disadvantages; however, they all successfully deliver energy into utility grids. Variable-speed turbines produce energy at slightly higher efficiencies over a wider operational range of wind speeds than constant-speed turbines. The power electronics necessary in variable-speed turbines to produce grid-quality electricity consume slightly more energy than capacitors used to condition the power from constant-speed turbines. Variable-speed turbines also provide the ability for the turbine to supply reactive power to the grid and dynamically control the reactive power supply (power factor) to the grid. This feature can be advantageous to the operation of the transmission system particularly in remote portions of the transmission system where voltage control can be difficult and costly for the system operator to maintain. Typically, reactive power and its effects are managed through the use of larger conductor sizes, capacitor banks and special reactive power supply equipment. Remote wind energy projects that have the ability to produce or consume reactive power with either a static or dynamic power factor can mitigate costly equipment on the transmission system. Turbines that do not utilize variable-speed technology provide close to unity power factor by using switched capacitors at the turbine and, in some cases, at the project substation. The effect of constant-speed systems on the grid results in the consumption of reactive power. This reactive power must be supplied from other transmission system resources. Transmission system operators are increasingly interested in using remotely located wind energy projects to assist in providing voltage support and control.

Fixed-pitch turbines generally have fewer moving parts and are less complex than variable-pitch turbines, resulting in lower manufacturing costs. Variable-pitch turbines are able to optimize blade pitch and adjust it for changes in air density or blade contamination. For these and other reasons, the energy output from variable-pitch turbines is somewhat higher than fixed-pitch turbines, thus offsetting the higher system costs. In locations with large variations in temperature, and thus air density, fixed-pitch turbines can experience difficulties with excessive power production during periods of high air density if the blades are pitched in a manner that optimizes production throughout the year. The specific wind and climate characteristics at a given site ultimately determine which type of control scheme generates energy most cost effectively.

Small Turbines

Most small turbines are much less sophisticated. Several resources on small wind turbines covering both technical and non-technical information are readily available on the Internet. A few of these resources include the following:

- New York Public Service Commission Website – interconnection requirements for distributed generation systems between 15 and 300 kW. This document includes technical requirements as well as non-technical requirements such as fees, forms, and insurance.
- California Energy Commission (2002) – Buying a Small Wind Energy System. This document discusses grid intertied small systems.
- Mick Segrillo (2002) – Choosing a home-sized Wind Generator. He reviews most wind generators sold and supported in the U.S. and includes technical descriptions of each.
- U.S. Department of Energy, EERE – Small Wind Electric Systems: A U.S. Consumer's Guide. This document includes information on sizing, zoning issues, technical information, how to choose a turbine, connecting a turbine to the grid, insurance, and off-grid applications.

Figure 5 presents a comparison of small wind turbines with common structures.

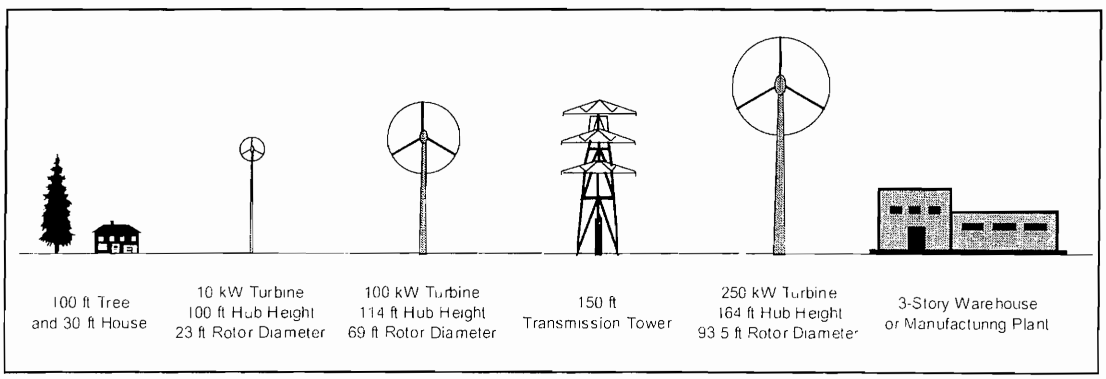

Figure 5. Small Wind Turbine Height Comparisons

Applications

Distributed Generation

Residential

Small wind turbines can be grid-connected for residential generation or they can be used in off-grid applications such as water pumping or battery charging. Small turbines are typically installed as a single unit or in small numbers. The smallest turbines (with power ratings less than 1 kW) are normally used to charge batteries for sailboats, cabins, and small homes. Turbines with power ratings between 1 kW to 20 kW are normally used for water pumping, small businesses, residential power, farm applications, remote communication stations, and government facilities. They are often found as part of a hybrid system that can include photovoltaic cells, grid power connections, storage batteries, and possibly back-up diesel generator sets. Small turbines with power ratings between 1 kW and 20 kW can be connected to single-phase electrical service that is typical in almost every home.

Turbines less than 1 kW are usually customer installed on short pole-type masts which can be located on roofs or boats. For turbines over 1 kW, tower heights can range from 12 m (40 ft) to 36 m (120 ft). Rotor diameters range from 1.1 m (3.5 ft) for a 400 W turbine to 15 m (49 ft) for a 50 kW turbine. For towers that use guy wires, the guy anchors are typically spaced one half to three quarters of the tower height from the base. A steel base plate or concrete foundation is necessary to adequately support the tower, depending on the turbine and tower size. Monolith-type concrete foundations are approximately 3 to 6 ft square. Free-standing towers can require construction of more elaborate concrete piles for each tower leg. Tilt-down towers are also available to facilitate easier access for maintenance.

Grid connected systems may be practical if the following conditions exist:

- The wind resource averages at least 10 mph over the course of the year.
- Local electrical rates are high – ranging from 10 to 15 cents per kilowatt hour (¢/kWh).
- The local utility requirements for connecting a small wind turbine are not prohibitively expensive.
- Good incentives for the sale of excess electricity or for the purchase of a small wind turbine exist.

Industrial

Industrial-scale wind turbines can range in size from 50 kW to 250 kW and are typically used in light commercial/industrial and village power applications. Industrial turbines typically utilize rotor diameters between 15 m (50 ft) and 30 m (100 ft) and hub heights between 25 m (80 ft) and 40 m (131 ft). Resulting maximum tip heights can vary from 30 m (100 ft) to 55 m (180 ft). Industrial-scale turbines require connection to three-phase electrical power found more typically in commercial and village power applications, as opposed to residential locations. These turbines are installed by construction crews with the guidance of the turbine manufacturer. Electrical interconnection would be guided by the local utility.

Harbec Plastics Inc. in Ontario, New York, installed a 250 kW wind turbine to help offset electric purchases. This particular turbine is on a 130-ft (39.5-m) tower and has a rotor diameter of 98 ft (30 m). More information on the Harbec wind turbine is available on the internet at http://www.northerndevelopment.com/renewableenergy.html.

Community

Though large wind turbines are most commonly deployed in large arrays of multiple turbines, they are also installed in distributed generation applications that consist of a single or a few turbines connected directly to a distribution line. Common examples include installing one large turbine to offset electric purchases at a school, or a municipality or electric cooperative may wish to install a few large wind turbines to offset electric needs at municipal buildings or to supplement the bulk energy purchases of a cooperative on behalf of its customer-owners.

Bulk Power Delivery

Most wind energy projects in the U.S. are commercial facilities that generate electrical energy for delivery and sale on the bulk power system (the grid). Most current commercial wind power plants range in size between 20 and 300 MW. The type of turbine utilized in the project determines the number of turbines installed at a site.

The three existing wind power plants in New York State are typical examples of medium- to small-sized wind energy projects in terms of the number of turbines and the installed MW capacity. Larger wind projects (100 MW or more) have been installed in several locations in the western U.S. The Maple Ridge Wind Farm in Lewis County that will be operational in 2005 is considered a large, utility-scale project.

Figure 6 provides an illustration of the components that comprise a typical wind energy project. Groups or rows of wind turbines are positioned for optimum exposure to the prevailing winds while accounting for terrain variations. Inter-turbine spacing is selected to maximize production while minimizing exposure to damaging rotor turbulence. Inter-turbine and inter-row spacing vary as a function of the rotor diameter and the wind resource characteristics. Because wide spacing between wind turbines generally maximizes energy production but increases infrastructure costs (e.g., land, cabling, and road building), costs must also be considered when creating a project layout. A trade-off exists between optimizing the turbine location for energy production (through wider spacing) and maintaining reasonable turbine interconnection costs, which increase with wider spacing. Experience, mathematical analysis, and cost considerations are employed to determine the optimum configuration given all of the existing site conditions and proposed turbine equipment[1].

The majority of civil and electrical work required to design and construct a wind power plant is similar to the same activities for other power plants. In addition to the wind turbines and towers, wind power plants contain other components that are necessary for proper operation:

- Electrical Power Collection System – Energy produced from the turbines is collected in a medium-voltage (approximately 25-35 kV) power collection system consisting of below-ground cabling within the turbine rows and above-ground power lines from the turbine rows to the main substation (see figure 6). The interconnection point to the utility line can be co-located in the substation or it can be physically separated and located adjacent to the utility line. In general, wind energy projects are positioned within 1 to 10 miles from the high-voltage transmission line to minimize costs associated with the interconnection. However, greater distances may be economically feasible if the wind resource is sufficiently high. Pad-mounted transformers, generally located immediately adjacent to the base of each tower, are used to transform the low-voltage power produced by the turbine to the higher voltage of the on-site electrical collection system.
- Substation and Interconnection – For most wind energy projects, electrical energy produced by the turbines passes through a substation where it is metered and the voltage is increased to match the voltage of the utility grid. Plant isolation breakers, power quality monitors, and protective equipment are also present in the substation to protect both the electrical grid and the wind turbines. A system of switches and overhead infrastructure is used to connect the substation to the utility's power lines.

[1] For more information on land requirements and multiple land uses, see the Land Requirements section of the NYSERDA Wind Energy Toolkit

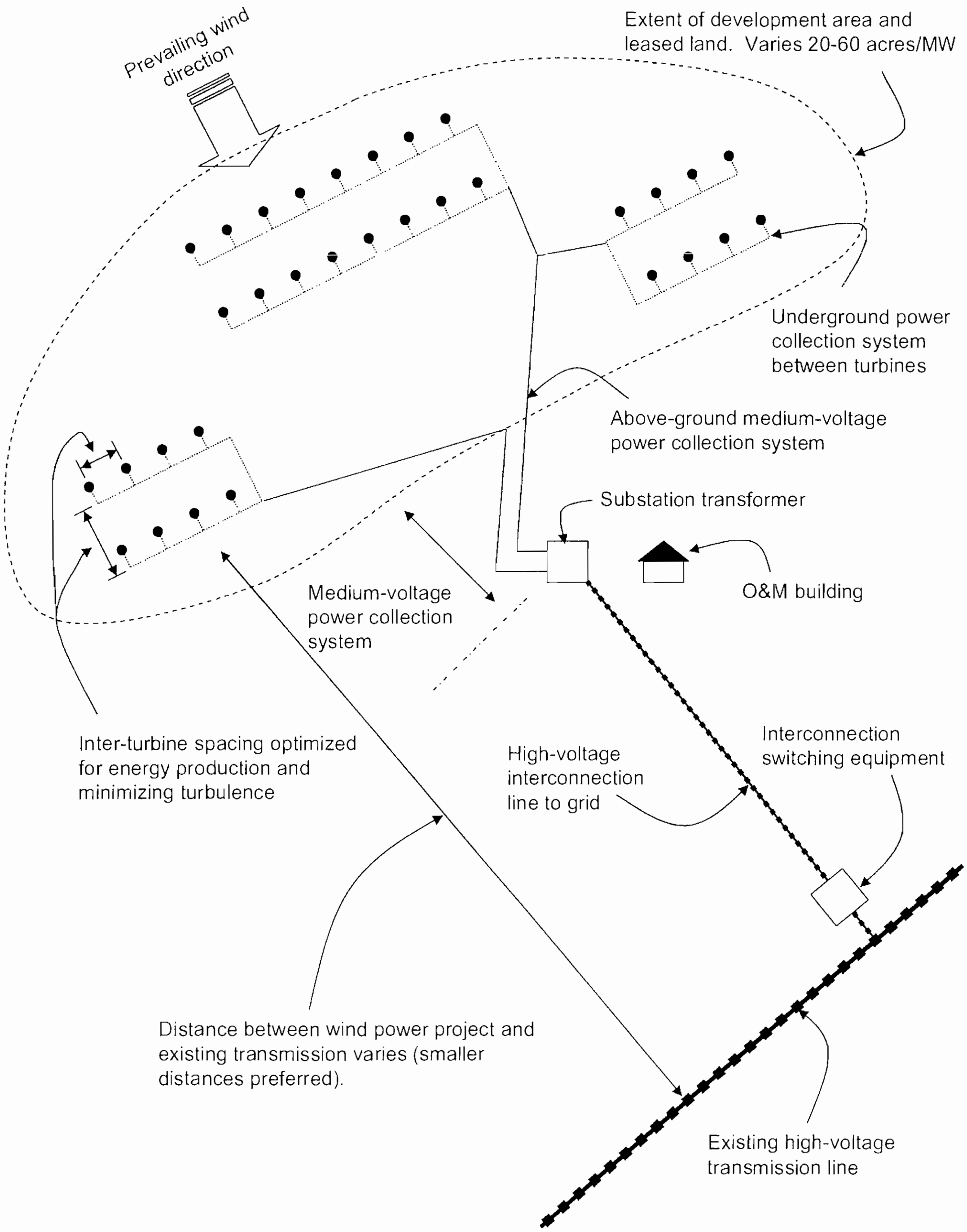

Figure 6. Typical Wind Energy Project Components and Layout

- Foundations – In general, the foundation design is based on the weight and configuration of the proposed turbine, the expected maximum wind speeds, and the soil characteristics at the site. Typical foundation approaches include an inverted "T" slab design and the patented concrete cylinder design (Figure 7 and Figure 8, respectively).

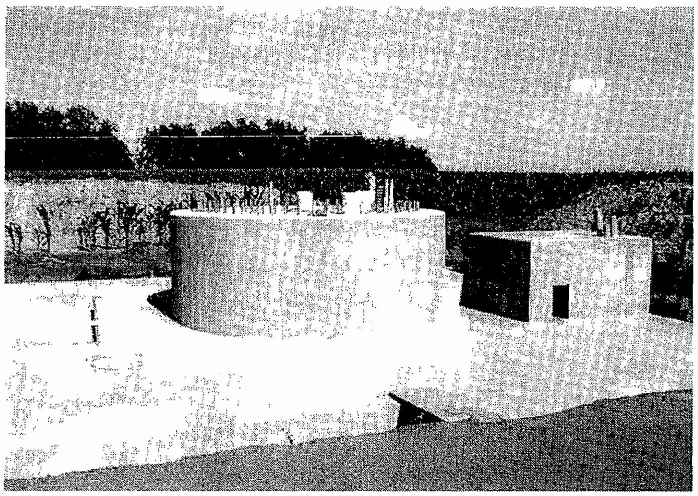

Figure 7. Inverted "T" Slab Foundation

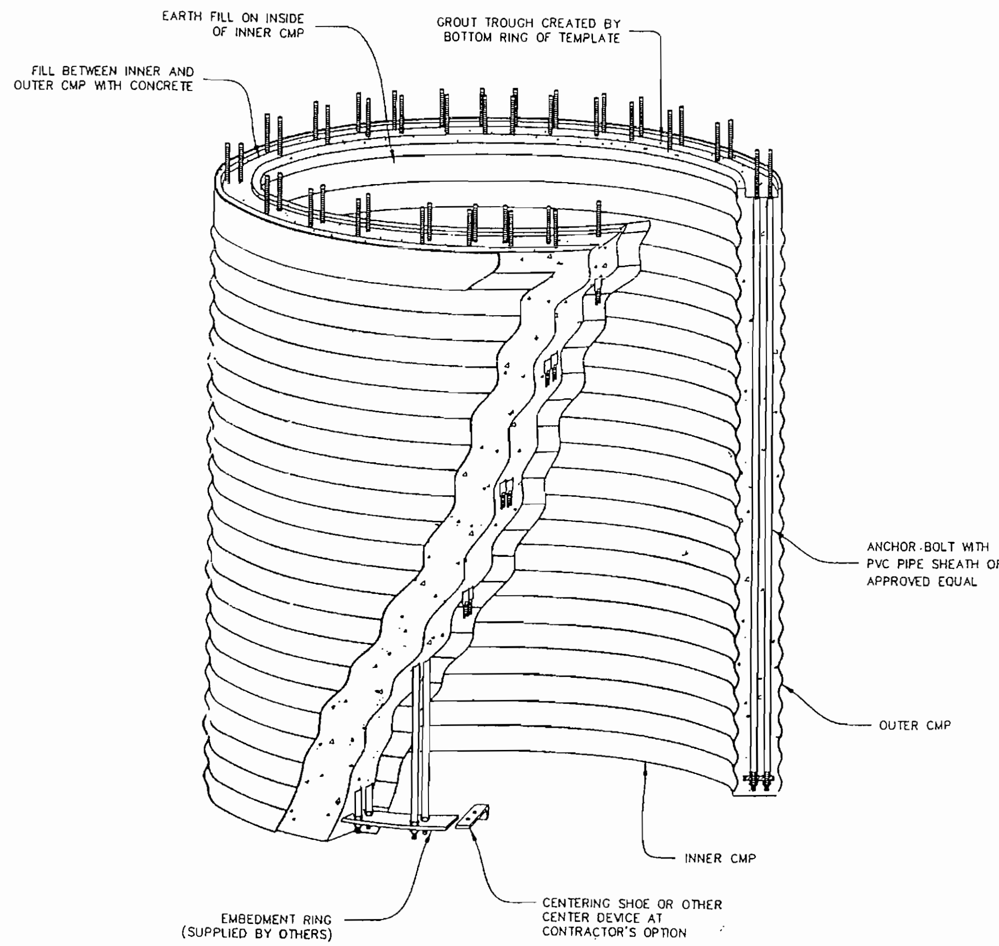

Figure 8. Concrete Cylinder Foundation

<u>Control and Communications System</u> – In addition to individual turbine control systems on each machine, a wind project typically includes a Supervisory Control and Data Acquisition System (SCADA). SCADA systems consist of a central computer with control capabilities for individual turbines and the ability to collect, analyze, and archive time-series data. Communication cables connecting the central computer with the individual turbine controllers are commonly buried in the same trenches as the electrical collection system.

<u>Access Roads</u> – Access roads to each turbine location are typically 18 to 20 ft wide and consist of compacted crushed rock. In hilly or complex terrain, access roads are constructed to specified slopes and turning radii that are necessary to allow delivery of large components such as blades and tower sections. During the construction

phase of a project, 'crane pads' (flat, well graded and compacted areas constructed of crushed rock) are installed along the access road and adjacent to the tower foundations. During project operation, the crane pads remain in place in the event that a crane is required to replace large components that cannot be handled by the service crane in the turbine.

- Operation and Maintenance (O&M) Facility – O&M facilities for wind power plants generally consist of an office and maintenance shop. These spaces can be located on site or off site and in some cases may be in separate locations. An office is necessary for plant management staff, control computers, and communication systems. The maintenance shop is used to store vehicles and spare parts, and provides a work space for the repair of turbine components.