Wind Energy Site Assessment
NON-PROFIT/BENEFACTOR MODEL

Prepared for: **St. John's Prep**

Subject Property: **72 Spring Street**
Danvers, MA

Date: **4/3/11**

AERONAUTICA Windpower

awd ASSOCIATED WIND DEVELOPERS

Wind Energy Analysis

Contents

1. Overview

This analysis was performed to provide an initial evaluation of the potential to utilize wind energy to produce electricity at the subject location. It was undertaken at the request of Tim Machaeik from the Daughters of St. Paul facility.

The report provides an initial assessment of the suitability of the proposed site for one or more wind turbines. It is designed to provide the owner with enough basic information about the potential of a wind turbine at the site to allow them to make an educated decision to proceed with the first phase of a project. In the case of non-profit organizations, the next phase includes the funding of some initial permitting and public relations efforts (with neighbors, etc.) and the ***identification of donor/benefactors***.

The analysis uses published wind maps in order to determine its potential value as a wind power site. In many cases this information alone will be enough for the owner to make a decision. In other cases, especially if the winds are marginal, or if outside financing requires it, a more refined approach using powerful computer modeling or actual wind data collection efforts may be required. In this specific case there are other wind studies that have been produced within the region which should provide enough data for a complete decision to be made.

The report will also attempt to spotlight any broad "fatal flaws" which might preclude the owner from moving forward in considering this type of wind power project. While it takes a broad look at the zoning process, it does not get into the details of micro-siting or the permitting process. This work is conducted in the initial phase of the project.

The analysis concludes with some excellent consumer information published by many sources which the owner should find of value in considering this sort of energy project.

2. The Site

The proposed site is a Private High School Campus located along Spring Street, in the town of Danvers, MA. A plot plan is attached for reference. Latitude: 40.583, Longitude: -70.598, Elevation: 15m above sea level. The land is owned by a religious order. There is a high energy use on the property.

General observations:

1. The site is located at or near the top of a hill within the town.
2. The land appears to be well suited for a Community Wind project.
3. The owner wishes to implement energy savings projects on site to reduce energy usage

Google Earth Image

3. The Wind Resource

Average wind speeds will vary according to the height above ground. Because the power output of a wind turbine varies as the cube of the wind speed, a small amount of increased speed results in a substantial increase in power generation.

The wind speed at the site was estimated using both the 3-Tier FIRSTLOOK and Mass MRET Commonwealth Wind Site Resource tool. The MRET tool tends to provide more realistic expectations, yet an average of the two results will be used to be conservative.

The FirstLook tool returned a range of values at 60 meters of 5.3 m/s.

The MRET tool returned the values below, which are corrected for local obstacles. These values are used as the basis of this analysis:

Hub Height		**Wind Speed**	
Meters	**Feet (ft)**	**Meters/Sec**	**Miles/Hr**
30	98	6.4	14.2
50	164	6.9	15.4
70	230	7.5	16.7

Table 1

Averaged, the site appears to exhibit an average annual wind speed of 6.1 m/s. This is the value that will be used in this analysis. The value gets corrected to 6.2 m/s when the difference between the measurement height of 60m and the hub height of 65m.

The MRET and 3 Tier analysis is attached to this report.

This site is considered to be in an area of good wind of a commercial nature.

MCEC Commonwealth Wind Site Resource Report

Report Date: 2/23/2011
Report Completed By: Shaun W. Lockett
Site Name: St. John's Prep

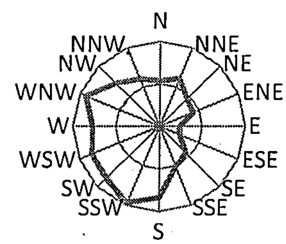
MASSACHUSETTS CLEAN ENERGY CENTER

Site Information

Latitude (Tower Location)	42.5837	(decimal degrees)
Longitude (Tower Location)	-70.5989	(decimal degrees)
Elevation (m)	0	

Direction	Frequency	Obstacle Height (m)	Description
N	5.36%	0	
NNE	6.08%	0	
NE	4.55%	0	
ENE	4.29%	0	
E	2.33%	0	
ESE	2.62%	0	
SE	4.41%	0	
SSE	5.07%	0	
S	8.33%	0	
SSW	9.67%	0	
SW	8.59%	0	
WSW	8.48%	0	
W	7.76%	0	
WNW	9.27%	0	
NW	7.15%	0	
NNW	6.04%	0	
Avg Obstacle Height (m)		0	

Site Wind Rose (5% frequency/division)



5.44

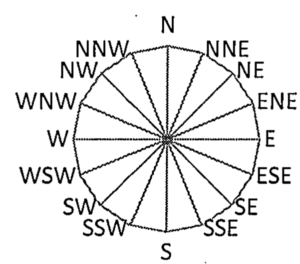
1

2.465

7.4

2.3

Obstacle Height (10 ft/division)



Wind Resource Statistics

Weibull k Value	2.23
Average Site Wind Shear Exponent	0.35

Wind Map Reference Height (m)	Wind Map Wind Speed (m/s)	Corrected for Site Factors (m/s)
30	6.4	6.4
50	6.9	6.9
70	7.5	7.5

Wind Map Wind Speed Point

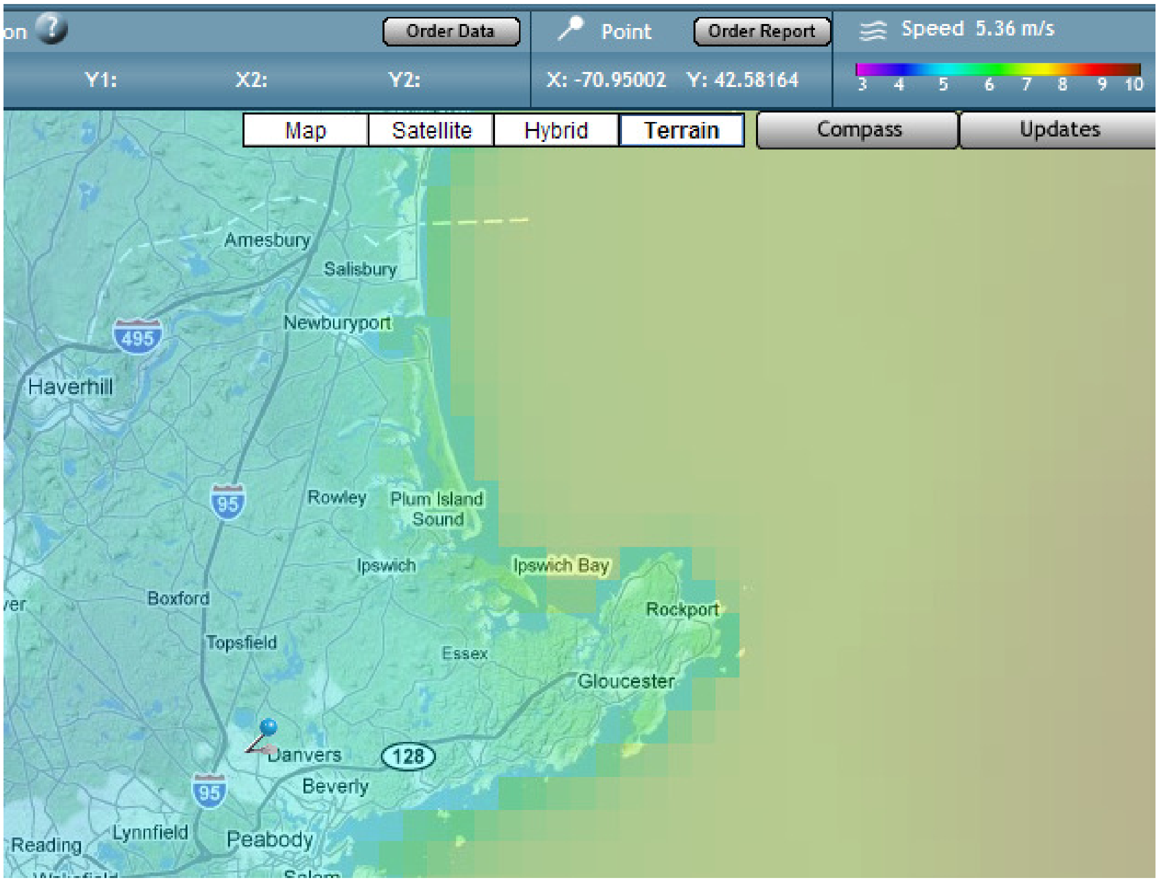
Latifitude	42.601872
Longitutde	-70.634697

Note: The average site wind shear exponent is based on empirical data for various terrain types and is calculated based on user inputs. It is recommended that the user use this value to estimate hub height wind speeds, rather than calculating a wind shear exponent based upon the wind speeds from the wind map, as these values are based on large scale computer models and do not accurately account for micro-siting conditions. The wind shear exponent is a mathematical representation of terrain roughness and is used to calculate wind speed as a function of height.

The data displayed in this report is intended for preliminary assessment purposes only and should be combined with an appropriate feasibility study to determine project viability. This tool has been developed by the Cadmus Group, Inc., on behalf of the Massachusetts Clean Energy Center Wind resource data is derived from AWS Truewind New England Wind Map.

www.cadmusgroup.com Questions: pts@cadmusgroup.com

3-Tier Data – 60 meter height – 5.36m/s



4. Potential Energy Production

The energy production from any wind turbine is a function of the swept area of the turbine's blades, the size and efficiency of the mechanical system, and the aerodynamic efficiency of the blades. These factors combine to determine values for an individual machine's 'capacity factor' (the percent of time the machine can be thought of as running at its full rated output over the course of the year). When multiplied by the number of hours in a year (8,760), this allows us to produce an 'energy curve' for individual machines, which shows the overall energy output in KWHrs/yr at given annual average wind speeds.

While various machines will operate at slightly better or worse capacity factors, in general they will fall within a range of values which can be used to illustrate the amount of power from various standard size turbines. This allows the owner to see how much electricity could be produced by different sized machines at various heights.

The selected wind turbine for this project, and Aeronautica 54-750kW turbine, is expected to produce 1,705,000 kWhrs per year (142,135 kWhrs/mo) given the wind speeds discussed in Section 3.

Note: the wind speeds and turbine output values represented in this report should be taken as estimates and should in no way be interpreted as a guarantee of the average annual wind speed or the average annual output of any specific turbine at this site.

5. Use of the Power and Configurations of the Application

The site in question has a large on-site load. In addition, it is located in a community that has a Municipal Light Plant facility, and is therefore not required to participate in MA net metering regulations. Therefore the highest and best use of the electricity provided will be for a BEHIND THE METER application, with the site using all of the power produced by the turbine. The on-site load is estimated to be 2,609,600 kWhrs/yr from electric bills. At current usage, a 750kW turbine will produce about 65% of the power needed by the property. Even though the local power company is not required to offer net metering, it is suggested that they be asked to offer this service, since it would be a more cost effective way of hooking up to the campus grid.

It is important for the land owner to understand how the interconnection of a wind generator can affect the economics of the installation so that the proper sized unit can be installed. The economics of wind power are maximized by several factors:

- The swept area of the rotor. Generally, larger machines benefit from economies of scale, and produce more power per installed dollar.

- The installed cost, which includes permitting and engineering costs related to regulatory issues and public resistance through the zoning laws. Many projects which propose the largest turbines are the hardest (and costliest) to get approved, simply because of resistance from the neighbors or a restrictive zoning law.

- How the turbine is connected to the load use and how excess power is conserved, sold or wasted. The most popular types of service configurations include:

  - **Behind the Meter** – the turbine generator is simply used to service the on-site load, and displaces electricity drawn from the grid. The turbine is carefully sized so that there is little excess power produced, because any such power is wasted. This is typically found in areas where the following options are not available.

  - **Merchant Power** – where the power is generated for sale to the 'grid' and sold at a wholesale rate. This is typically done on larger wind farms, rather than servicing local point loads. In New England, this rate is about $.06 per KWHr, which is the ISO's 'avoided cost'.

- **Net Metering** – the most popular and profitable approach. In net metering, the turbine is connected 'behind the meter' but the power company regulations allow excess power to 'run the meter backward' (or the site is dual-metered). This typically results in the highest financial benefit, since the full retail cost for delivered power from the power company is displaced by power from the turbine.

  In July 2008, net metering was significantly expanded to establish three separate categories of net-metering facilities. The order instituting rulemaking was issued in March 2009 and proposed rules have been issued. "Class I" facilities are generally defined as systems up to 60 kW in capacity. "Class II" facilities are generally defined as systems greater than 60 kW and up to one megawatt (mW) in capacity that generate electricity from agricultural products, solar energy or wind energy. "Class III" facilities are generally defined as systems greater than 1 mW and up to 2 mW in capacity that generate electricity from agricultural products, solar energy or wind energy.

  The state's investor-owned utilities must offer net metering. Municipal utilities are not obligated to offer net metering, but they may do so voluntarily. (There are no electric cooperatives in MA.) The aggregate capacity of net metering is limited to 1% of each utility's peak load.*

  Net metering can take the form of 'physical' or 'virtual' metering. In physical net metering, the wires actually run through the facilities and their meters. With virtual net metering, the generator is hooked up directly to the grid and its output metered. The power output is handled more as a billing exercise, where the customer could 'assign' the excess power to other meters within the local distribution company's service area. These meters could presumably be owned by the turbine owner, or could be friends or other neighbors, with whom some financial arrangements could be made for the sale of excess power.

  The DPU is expected to mandate and enforce rules for the new energy bill's provision of 'virtual net metering'. In the event this does not occur, some physical net metering to neighboring buildings may also be an option, as long as the cost of distribution (poles and wires) is not prohibitive. The energy bill also includes a 'neighborhood net metering' provision.

6. Potential Savings/Value

This report suggests that the most probable use of a wind turbine at this facility would be to provide 'Behind the Meter' power. The annual demand for the various on-site loads is estimated to be 2,609,000, with 1,705,000 kWhrs/year supplied by the turbine. A review of the campus electric bill reveals that the school pays the Town of Danvers $.043/kwhr for an 'Energy Charge', and $.051 for a 'Power Purchase and Fuel Adjustment' charge. The total of these values is $.094/kWhr, which has been taken as the cost of the energy provided/kwHr. This represents the average value of the displaced power when used behind the meter. IT should be noted that the demand portion of the electric bill cannot be offset by windpower, since the full demand charge may be required at any one time when the wind is not blowing. Therefore, although the demand charge is also typically lowered after a turbine installation, it cannot be counted upon and is ignored in the analysis.

There are other valuable considerations for wind generated electricity. The value of Renewable Energy Credits (RECs) or 'Green Tags' as they are often called, should not be overlooked. ***In the New England ISO market, RECs are currently trading at around $.025/kWhr***, and this value is expected to stay strong for the next 5-10 years, since the region does not have much 'green' power generation. RECs generally have a life of 10 years, and can be sold to many companies looking to 'buy' their way into being green through the purchase of these vehicles from many power brokers. *The sale of RECs would bring the effective rate of power produced by the turbine to about $.**119**/kWh. This is the value that is used in the economic model for the project as a return to the project owner.*

Another consideration, which is relatively new to the New England market, is the sale of production capacity on the Forward Energy Market auctions through ISO New England. Although this is something that the owner should look into, it will not be considered part of the economics of this report, since the values varies depending on the auction price.

Other valuable considerations which affect the effective rate of produced power from a Wind system in Massachusetts are as follows. Which regulations and policies are applied to this project will depend on the exact nature of the ownership vehicle employed in order to maximize the tax implications to the benefactor/donor program.

- **The Small Wind Systems Tax Credit**
  Description: Under present law, a federal-level investment tax credit (ITC) is available to help consumers purchase small wind turbines for home, farm, or

Electric Bill

Make Check Payable To and Mail To:

TOWN OF DANVERS
DPW BUSINESS DIVISION
P.O. BOX 3337
DANVERS, MA 01923-0837
Office (978) 774-0005 Fax (978) 774-3878
www.danvers-ma.org

Invoice Number	Customer Account Number	
1449547	01-5099428-00	
Discount Date	**Discounted Amount**	**Non-Discounted Amt**
04-14-2011	23,696.14	24,376.71
Service Address		**Amount Enclosed**
72 SPRING ST		$23,696.14

ST JOHNS PREP
SUMMER SPRING ST
DANVERS, MA 01923

01 5099428 00 12381 041411 0002369614 0002437671 5

Page 1 *Please detach top portion and return with payment* *Page 1*

Town of Danvers DPW
Office: (978) 774-0005

Account Number 01-5099428-00
Name ST JOHNS PREP
Service Address 72 SPRING ST

Meter Number	Read Dates Present	Read Dates Previous	Billing Days	Code	Meter Readings Present	Meter Readings Previous	Multiplier	Usage	Units
ELECTRIC: 0000012381	03-21-2011	02-17-2011	32	MR	22874	22607	800	213600	kWh
ELECTRIC: 0000012381	03-21-2011	02-17-2011	32	MR	60		800	480.00	kW

BILLING SUMMARY

Previous Balance as of : 02-28-11	$22,298.29
Payments & Adjustments 03-10-11	($22,298.29)
Balance Forward as of : 03-30-11	$0.00
Current Charges as of : 03-30-11	$23,696.14
Total Amount Due	$23,696.14

	Rate	Usage	Charges
PREVIOUS BALANCE			22,298.29
PAYMENT 03-10-2011			-22,298.29
BALANCE FORWARD			0.00
Energy Charge per Kwh	0.043000	213600	9,184.80
Customer Charge			10.00
Voltage Credit			-229.62
Voltage Credit			-108.00
Discount			-680.57
PURCHASE POWER & FUEL ADJ	0.051980	213600	11,102.93
Demand	9.000000	480	4,320.00
Sentinel Light Charge			40.00
Sentinel Light Charge			56.60
CURRENT CHARGES			$23,696.14
TOTAL AMOUNT DUE			$23,696.14

.094

Invoice Number
1449547

USAGE HISTORY

Month	Days	Electric Use (kWh)	Elec. Usage per day
03-11	32	213600	6675
02-11	28	203200	7257
01-11	30	194400	6480
12-10	33	220800	6691
11-10	27	170400	6311
10-10	32	205600	6425
09-10	32	204000	6375
08-10	30	204800	6827
07-10	34	244000	7176
06-10	30	193600	6453
05-10	27	162400	6015
04-10	34	205600	6047
03-10	27	187200	6933

2,609,600/YR
185,665/DAY

Invoice #
Date of Invoice
Date Received 4/4/11
Date Entered 4/4

Invoice Amount
Approved by
PO #
Account #s 1140005502 64
Check #
Check Amount

Bill Type	Account Type	Bill Date	Discount Date	Discounted Amt	Non-Discounted Amt
REGULAR	DEMAND GEN SERVICE	03-30-2011	04-14-2011	23,696.14	24,376.71

MESSAGES: CREDIT CARD CUSTOMERS.PLEASE CALL US IF YOU HAVE BEEN ISSUED A NEW CARD OR EXPIRATION DATE.THANK YOU
The all night parking ban begins on 12/01/10 and ends on 4/01/11.

business use. Owners of small wind systems with 100 kilowatts (kW) of capacity and less can receive a credit for 30% of the total installed cost of the system, not to exceed $4,000. For turbines used for homes, the credit is additionally limited to the lesser of $4,000 or $1,000 per kW of capacity.

Current Status: ***The ITC is also available in the form of a 30% CASH GRANT to the system owner (see next below), but this method is scheduled for termination if a project has not been started before 1/30/2011. Most benefactors will want to take advantage of this program.***

- **The Production Tax Credit (PTC) Extension**
  In October 2008, Congress acted to provide a one-year extension of the Production Tax Credit through December 31, 2009
  Description: Under present law, an income tax credit of 2.1 cents/kilowatt-hour is allowed for the production of electricity from utility-scale wind turbines. This incentive, the renewable energy Production Tax Credit (PTC), was created under the Energy Policy Act of 1992 (at the value of 1.5 cents/kilowatt-hour, which has since been adjusted annually for inflation).

- **Renewable Energy Grant**: The *American Recovery and Reinvestment Act of 2009* (H.R. 1), enacted in February 2009, created a renewable energy grant program that will be administered by the U.S. Department of Treasury. This cash grant may be taken in lieu of the federal business energy investment tax credit (ITC). In July 2009 the Department of Treasury issued documents detailing guidelines for the grants, terms and conditions, and a sample application.

  Grants are available to eligible property placed in service by 2011, or placed in service by the specified credit termination date, if construction began in 2009 or 2011. The guidelines include a "safe harbor" provision that sets the beginning of construction at the point where the applicant has incurred or paid at least 5% of the total cost of the property, excluding land and certain preliminary planning activities.

- **Local Property Tax Exemption for Residential, Commercial, and Industrial Installations of Solar, Wind, and Hydroelectric Energy Systems**
  Solar and wind energy systems and devices installed for supplying the energy needs of a residence or business are eligible for an exemption from local property tax. This exemption, which is good for 20 years from the date of system installation, applies only to the value of the renewable energy equipment reflected on the property tax bill, not the full amount of the bill.

- **State Corporate Income Tax Deduction for Purchases of Solar and Wind Energy Systems and Equipment**
  Businesses that purchase a solar or wind energy system are allowed to deduct from net income, for state tax purposes, any costs incurred from buying,

installing, and operating the unit, provided the installation is located in Massachusetts and is used exclusively in the trade or business of the corporation. The exemption is in effect for the length of the system's depreciation period. M.G.L. c. 63, sec. 38H(f)

- **State Corporate Excise Tax Exemption for Purchases of Solar and Wind Energy Systems and Equipment**
  Businesses that purchase a solar or wind energy system are allowed to deduct from net income, for state excise tax purposes, any costs incurred from buying, installing, and operating the unit, provided the installation is located in Massachusetts and is used exclusively in the trade or business of the corporation. The exemption is in effect for the length of the system's depreciation period. M.G.L. c. 63, sec. 38H

- **Rapid Depreciation**
  Double-declining balance, five-year depreciation schedule (I.R.C. Subtitle A, Ch. 1, Subch. B, Part VI, Sec. 168 (1994) (accelerated cost recovery system)) is another federal policy that encourages wind development by allowing the cost of wind equipment to be depreciated faster.

Production Output:

Although the various incentives and programs shown above will affect the overall financial pro-forma of any ownership model in a positive fashion, it is beyond the scope of this analysis to provide such a proforma for all specific machines. *Instead the report appraises the value of the potential wind site using the simple effective rate of power mentioned above, which is $.119/kWh*

At this point the value of the electricity saved can be combined with the production of the wind turbine to calculate the average expected annual gross revenue. The attached Focus Program is used to calculate this output and revenue. The result is an annual savings to the school of (1,705,624 kWhrs x $.119/kWhr =) $202,969 each year.

As part of the Non-Profit/Benefactor program, St. Johns Prep would recognize all of this savings as value to the organization. The only expense associated with the revenue would be the annual cost of Operations and Maintenance, which is estimated at $26,500 for twice annual service calls and consumables, and which includes a $3,500 per year management fee for Aeronautica to provide internet monitoring and coordination between the school and the benefactor/donor group.

Typical Installed Costs of the System:

Based on experience the Aeronuatica 54-750kW wind turbine will install between $1,950,000 and $2,300,000, depending on issues such as tower height, permitting costs and other variables.

This specific project is expected to have an installation cost of $2,128,300, which is comprised of the following:

$ 64,300	Permitting and Studies
$1,480,000	Turbine and Foundation
$ 648,300	Balance of Plant

$2,128,300 Total Estimated Cost

7. Concerns

The following concerns are offered as issues that should be investigated more thoroughly in a full feasibility study before any wind project is undertaken.

Town of Danvers Approval –
The town of Danvers does not currently have any specific zoning bylaw for wind energy facilities of a commercial or utility scale. Setbacks for the properties in question are 40′ on all sides and 35′ maximum height. Also, being a private religious institution, it is unclear as to the latitude that the organization may have to erect a turbine.

In general, towns that do not have a specific wind turbine bylaw will opt to enforce a bylaw for similar tall structures, such as cell towers. Some towns will enforce a ‘clear zone’ (fall zone) around such a structure, and some will not. Even if a clear zone is not required, other considerations, such as noise or flicker issues, may create a similar setback requirement from other residences.

Land Area/Siting Locations –

Generally, town bylaws will require a ‘clear zone’ around the tower equal to the blade tip height. The ability to utilize a wind turbine at this site fully depends on whether the town will insist on setbacks, as the shape of the land and the available acreage would seem to preclude any setbacks greater than approximately 250′, which is the minimum radius needed to situate a 750kW machine (a smaller 225kW machine would seem to fit).

General Noise Issues - Noise considerations generally take two forms, state regulatory compliance and nuisance levels at nearby residences:

A. *Regulatory compliance:* Massachusetts state regulations do not allow a rise of 10 dB or greater above background levels at a property boundary (Massachusetts Air Pollution Control Regulations, Regulation 310 CMR 7.10). In most cases modern turbines are quiet enough to meet these criteria easily. Mid-scale turbines, while slightly noisier due to increased tip speeds, are also normally masked by the sound of the rushing wind. In general, all wind turbines should be located a minimum of 600′ from any residence. There is no case precedence for dormitories or other private housing. However, ‘best practices’ must be followed, and this would lead to an approximate minimum of a 250′ setback from on-site residences.

B. *Human annoyance:* Aside from Massachusetts regulations, residences must also be taken into consideration. Any eventual wind turbine would need to be sited such that it would be inaudible or minimally audible at the nearest residences.

At this specific site, the noise to the neighboring residences will need to be evaluated closely, as there are residences within 600′ of one of the proposed turbine locations.

Specific Environmental Permitting - The site must adhere to any rules and regulations pertaining to wetlands and other environmentally sensitive issues. This is beyond the scope of this analysis, but no wetlands appear evident.

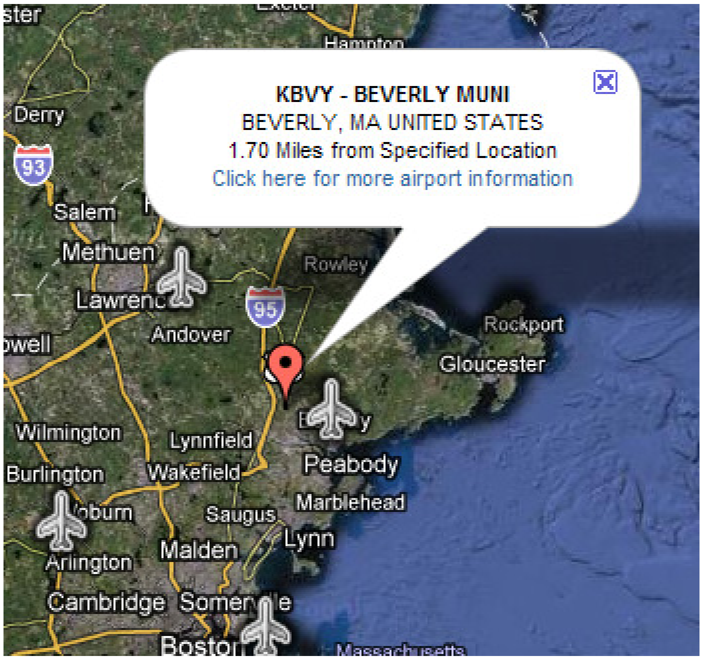
Flicker Issues - At low angles (morning and afternoon) the sun shining behind the moving turbine blades will form a 'flickering' shadow. Any structures within this shadow may experience at least an annoyance. Flicker studies are conducted by full feasibility studies and are outside the scope of this analysis. At least a few residences and commercial buildings around this site should be evaluated for flicker effects. Flicker can be controlled by turning the computer controlled wind turbine off at any required time periods, with the attendant loss of revenue.

General Airspace Issues- The form "7460-1 - Notice Of Proposed Construction or Alteration" must be filed with the Federal Aeronautics Commission (FAA) before construction of any structure over 200 feet (i.e. all utility-scale wind turbines). The corresponding form for the Massachusetts Aeronautics Commission (MAC form E10, Request for Airspace Review) must also be filed.

While the response of the FAA or DOD cannot be predicted, most sites that are not within about 3-5 miles of a public or military airport are not considered a hazard to air traffic. At this preliminary stage, we simply examine fatal flaws by considering the distance to public and other runways. The FAA requires that any structure over 200′ be lit. All utility-scale wind power installations are lit. Mid-scale machines are lit on a case-by-case basis.

Specific Airspace Issues –

There is a small airport at the Beverly Municipal Airport which is within 1.7 miles of the property. This is not expected to be a fatal flaw, but must be evaluated by the FAA.


KBVY - BEVERLY MUNI
BEVERLY, MA UNITED STATES
1.70 Miles from Specified Location
Click here for more airport information
Hampton
Derry
93
Salem
Methuen
Rowley
95
Andover
Rockport
Gloucester
Wilmington
Lynnfield
Peabody
Burlington
Wakefield
Saugus
Marblehead
Lynn
Malden
Arlington
Cambridge

8. Conclusions/Next Step

*It is the opinion of this report, based on the published Doppler radar wind maps, that the subject property appears to have **good commercial wind** and the on-site load to support a commercial scale wind turbine such as the Aeronautica 750, and that it would be a good candidate for the Aeronautica Non-Profit/Benefactor Program.*

Next steps:

The next step would be for the school to approve of a potential project, which would be contingent upon several key issues, including:

1. *Determination of either outside or internal benefactors for the project. If internal (donors already identified with the school) cannot be found, AW has a number of Catholic benefactors who would be interesting in participating.*
2. *Determination of FAA height restrictions, if any. (30 days)*
3. *Determination of any fatal Zoning ordinances (30 days)*
4. *Procurement of any and all zoning and other permits to construct a turbine (4-6 months)*

Aeronautica Windpower and Associated Wind Developers stands ready to assist St. Johns Prep in coordinating such a wind energy project and supplying all of the required expertise for the job.

As part of the Non-Profit Wind Benefactor Program, we are willing to schedule and meet with potential donors to explain in detail the tax implications of making a donation to the school of a wind turbine under this program.

THANK YOU!

9. Our Background

Brian D. Kuhn

VP Development: Aeronautica Windpower, LLC
Principal: Developers Marketing Services
11 Resnik Road
Plymouth, MA 02360
800-360-0132 (o)
508-364-9489 ©
brian.kuhn@AeronauticaWind.com

Professional Bio:

Brian Kuhn is the Principal of *Developers Marketing Services* of Plymouth, MA, which offers consulting services and project development expertise in the Renewable Energy and Real Estate industries. His current business activities include the formation of, *Aeronautica Windpower*, a venture for establishing a wind turbine manufacturing facility in Massachusetts.

Brian holds a *Bachelor of Science* degree in '*Renewable Energy Systems and Business*', from the University of Massachusetts, in Amherst, MA ('77), where he studied under Professor *William Heronemus*, a noted naval architect and world renowned primary investigator for off-shore wind systems. He was a member of a small team of engineers that designed and built the first *UMass Solar Habitat and Wind Furnace* for the Department of Energy. This wind turbine introduced many innovations, including the use of a 3 bladed, variable pitch rotor and the use of a monopole tower – features that are now standard in today's modern wind turbine designs. The *Wind Furnace* turbine is currently heading to a new home at the Smithsonian Institute in Washington.

Brian currently serves as a Professor at Cape Cod Community College where he teaches the Wind Energy curriculum within the Environmental Sciences department.

Mr. Kuhn offers the perspective of over 30 years of product and service development. As *National Solar Specialist* for *Rheem Manufacturing* in the early '80s, he taught hundreds of distributors and dealers across the country how to design and install solar hot water systems. He has had several articles published about solar and wind power. He is a member of the *National Association of Home Builders* and the *Northeast Sustainable Energy Association*. He is also a past member of the *National Association of Realtors*, and is licensed as a real estate broker involved in land procurement and development projects across the Northeast.

Mr. Kuhn currently serves as Chairman for the *Plymouth Energy Committee* (PEC), a volunteer advisory group which reports to the Board of Selectmen of Plymouth, Massachusetts. Brian is the principal author of '*Plymouth 2020*', a plan which calls for virtually all of Plymouth's Municipal electricity to be produced by renewable sources in time for the town's 400th anniversary.

10. Supplemental Information

For more background information
This report assumes that the reader has some familiarity with wind power technology. If the reader is interested in a 'primer' for the industry, or wants an introduction to these areas, we suggest using either the MTC web site (www.MassTech.org) or the UMass Renewable Energy Labs (RERL's) Community Wind Fact Sheets, which are available on the web at: http://www.ceere.org/rerl/about_wind/.

Additional information on wind turbine technology and general information can be found at:

- Massachusetts Technology Collaborative, www.MassTech.org
- American Wind Energy Association, www.awea.org
- Danish Wind Industry Association, www.windpower.org

Use of this report
This report is considered proprietary to the owner, and is intended to be used in consultation with the owner as they develop plans to utilize the wind resource.

Prepared by:

Aeronautica Windpower, LLC
Plymouth, MA

April 11, 2011

St. Johns Prep

Danvers MA

AW54-750
1

FOCUS©
Wind Site Evaluator

FOCUS©

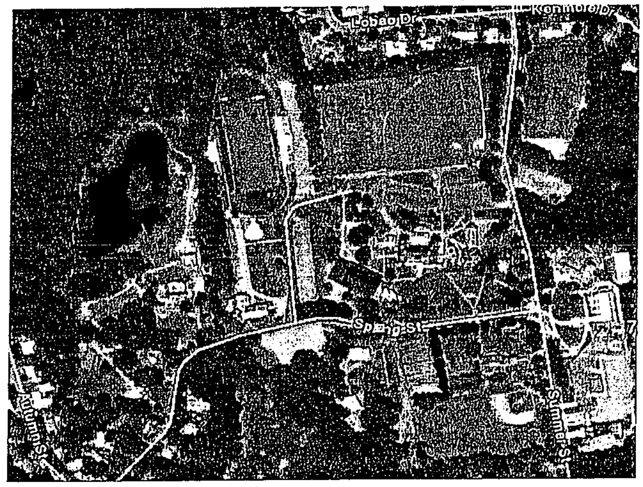
Wind Site Evaluator

St. John's Prep

St. John's Prep
72 Spring Street
Danvers MA
4/11/2011 11:38

Latitude:	42.583700
Longitude:	70.598900
Elevation (ASL):	15

Notes:
Wind data from wind maps only. This model assumes benefactor purchase, and therefore no financing costs. Assumed netmetering, at $.119/kwhr is school's cost of power. This model is from the school's point of view (savings), not benefactor. Net result is that school will save about $200,000/year plus escalation.



System:

Turbine:	AW54-750
Quantity:	1
Turbine Portion of Project:	$1,480,000
Balance of Plant Portion:	$648,300
Total Project Cost:	$2,128,300

Environmental:

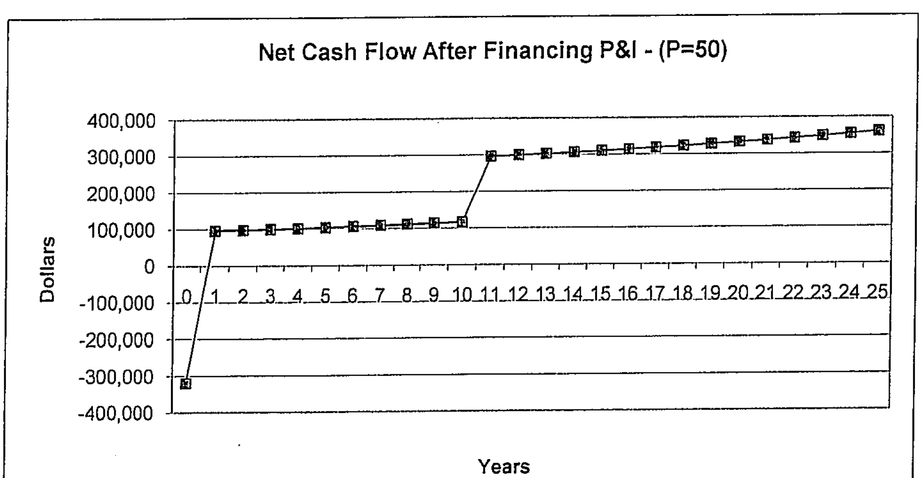
Avg. Wind Speed:	6.1
Hub Height:	65
Shear:	0.18
Corrected Speed at Hub:	6.19
Total Losses (Avail., Turb., Safety)	12.00%
Corrected Wind Speed:	6.19
Greenhouse Gas Savings Equivlent (CO2)	1,224.64 metric tons/yr

Investment Ratings (at P-50):

Simple Paybacks:	w/NO grants	7.83 years
	w/FED grants	5.83 years
	w/ALL Grants	5.83 years
Cost/kW: (Inst. cost/nameplate rating)		$2,838

	Before Fin.	After Fin.
Year 1 Cash Flow:	$271,984	$95,831
Year 2 Cash Flow:	$273,886	$97,733
IRR (over 10 years, excl. salv.)		11.9%
IRR(over 25 years, excl. salv.)		17.7%

Net Present Value (NPV)	$1,321,437	(w/out salv. value)
Avg. Annual ROI over 25 yrs	14.5%	(w/o fin. and depr.)
Ann. Ret. on Inv. Capital (over 25 yrs)	96.4%	(Infinite = $0 down)
Min. Cum Cash Position after Expenses:	$95,831	(Min position over 25 yrs)



Production:

Energy	1,705,624	kWhrs/yr
	142,135	kWhrs/mo
Revenue (25 yr. avg.)	$307,764	$/year
(25 yr. avg.)	$25,647	$/mo
Land Rental (1st year):	$0	$/year

Power Cost Assumptions:

Percent of Power Mix: Retail vs. Resale			0%	Retail
Retail:				
Current value of Retail Electricity (BTM oı			$0.119	$/kWhr
Contracted Disc. over Current Price:			0.0%	
Adjusted Retail Rate			$0.119	$/kWhr
Retail Escalators:			3.3%	per year
0.0%	0.0%	0.0%	0.0%	0.0%
Resale:				
Value of Resale (Sold to grid):			$0.150	$/kWhr
Resale Escal.			0.0%	per year
Value of RECs or Green Tags		$	0.025	$/kWhr
Escalator:			5.00%	per year

Financing Structure:

Is Project Financed? (Y/N	Y	Interest Rate	6.50%
Down payment	15%	Loan term (years)	10
Total Invested Capital			$319,245
Grants Applied against Financing:		$	542,717
Total Financed		$	1,266,339

Sensitivity:

	P-50	P-70	P-90
Wind Spd	6.19	5.97	5.65
Net kWhrs/yr	1,705,624	1,578,678	1,394,682
Year	*Net Cash Flow (from Ann. Proformas)*		
1	$95,831	$74,731	$44,150
2	$97,733	$76,486	$45,691
3	$99,739	$78,337	$47,317
4	$101,855	$80,289	$49,032
5	$104,086	$82,348	$50,842
6	$106,438	$84,519	$52,750
7	$108,918	$86,808	$54,762
8	$111,530	$89,220	$56,883
9	$114,284	$91,762	$59,119
10	$117,185	$94,440	$61,475
11	$296,394	$273,416	$240,111
12	$299,613	$276,389	$242,727
13	$303,003	$279,520	$245,483
14	$306,573	$282,817	$248,385
15	$310,331	$286,289	$251,442
16	$314,288	$289,944	$254,661
17	$318,453	$293,793	$258,050
18	$322,838	$297,844	$261,618
19	$327,452	$302,108	$265,374
20	$332,308	$306,595	$269,327
21	$337,417	$311,317	$273,487
22	$342,794	$316,286	$277,866
23	$348,450	$321,514	$282,473
24	$354,400	$327,014	$287,320
25	$360,660	$332,800	$292,420
totals	$5,932,573	$5,336,585	$4,472,764

25 year Financial Proforma

Project: *St. John's Prep*

Revenue Proformas - Cash Basis - w/out Tax Implications, P Value = 50

FOCUS Wind Site Evaluator

	Base Energy Value (Cash Revenue)							Expenses						Financing Costs			Results		
Year	Retail Revenue	Resale Revenue	Gross Elect. Revenue	REC Revenue	Federal Tax Grant [8]	Other Grants/Inc.	*Gross Revenue*	O&M	Insurance	Land Costs	Other Mgt	Other Exp.	*Net Revenue (EBITDA)*	Loan Interest	Loan Principal	Tot. Pmts. (CMLTD)	*Net Cash after CMLTD*	*Cum Net Cash Flow*	DCS w/RECs
0															Down Pmt.>	-319,245	*-319,245*		
1	0	255,844	255,844	42,641	0		*298,484*	-15,000	-8,000	0	-3,500		*271,984*	-82,312	-93,842	-176,154	*95,831*	*95,831*	1.54
2	0	255,844	255,844	44,773			*300,616*	-15,150	-8,080	0	-3,500		*273,886*	-76,212	-99,941	-176,154	*97,733*	*193,563*	1.55
3	0	255,844	255,844	47,011			*302,855*	-15,302	-8,161	0	-3,500		*275,893*	-69,716	-106,438	-176,154	*99,739*	*293,302*	1.57
4	0	255,844	255,844	49,362			*305,205*	-15,455	-8,242	0	-3,500		*278,009*	-62,798	-113,356	-176,154	*101,855*	*395,157*	1.58
5	0	255,844	255,844	51,830			*307,674*	-15,609	-8,325	0	-3,500		*280,240*	-55,430	-120,724	-176,154	*104,086*	*499,243*	1.59
6	0	255,844	255,844	54,421			*310,265*	-15,765	-8,408	0	-3,500		*282,592*	-47,582	-128,571	-176,154	*106,438*	*605,681*	1.60
7	0	255,844	255,844	57,142			*312,986*	-15,923	-8,492	0	-3,500		*285,071*	-39,225	-136,928	-176,154	*108,918*	*714,599*	1.62
8	0	255,844	255,844	60,000			*315,843*	-16,082	-8,577	0	-3,500		*287,684*	-30,325	-145,829	-176,154	*111,530*	*826,129*	1.63
9	0	255,844	255,844	63,000			*318,843*	-16,243	-8,663	0	-3,500		*290,438*	-20,846	-155,307	-176,154	*114,284*	*940,413*	1.65
10	0	255,844	255,844	66,150			*321,993*	-16,405	-8,749	0	-3,500		*293,338*	-10,751	-165,402	-176,154	*117,185*	*1,057,598*	1.67
11	0	255,844	255,844	69,457			*325,301*	-16,569	-8,837	0	-3,500		*296,394*	0	0	0	*296,394*	*1,353,992*	
12	0	255,844	255,844	72,930			*328,774*	-16,735	-8,925	0	-3,500		*299,613*	0	0	0	*299,613*	*1,653,605*	
13	0	255,844	255,844	76,576			*332,420*	-16,902	-9,015	0	-3,500		*303,003*	0	0	0	*303,003*	*1,956,608*	
14	0	255,844	255,844	80,405			*336,249*	-17,071	-9,105	0	-3,500		*306,573*	0	0	0	*306,573*	*2,263,181*	
15	0	255,844	255,844	84,425			*340,269*	-17,242	-9,196	0	-3,500		*310,331*	0	0	0	*310,331*	*2,573,512*	
16	0	255,844	255,844	88,647			*344,490*	-17,415	-9,288	0	-3,500		*314,288*	0	0	0	*314,288*	*2,887,800*	
17	0	255,844	255,844	93,079			*348,923*	-17,589	-9,381	0	-3,500		*318,453*	0	0	0	*318,453*	*3,206,254*	
18	0	255,844	255,844	97,733			*353,577*	-17,765	-9,474	0	-3,500		*322,838*	0	0	0	*322,838*	*3,529,091*	
19	0	255,844	255,844	102,620			*358,463*	-17,942	-9,569	0	-3,500		*327,452*	0	0	0	*327,452*	*3,856,543*	
20	0	255,844	255,844	107,751			*363,594*	-18,122	-9,665	0	-3,500		*332,308*	0	0	0	*332,308*	*4,188,851*	
21	0	255,844	255,844	113,138			*368,982*	-18,303	-9,762	0	-3,500		*337,417*	0	0	0	*337,417*	*4,526,269*	
22	0	255,844	255,844	118,795			*374,639*	-18,486	-9,859	0	-3,500		*342,794*	0	0	0	*342,794*	*4,869,062*	
23	0	255,844	255,844	124,735			*380,578*	-18,671	-9,958	0	-3,500		*348,450*	0	0	0	*348,450*	*5,217,512*	
24	0	255,844	255,844	130,972			*386,815*	-18,857	-10,057	0	-3,500		*354,400*	0	0	0	*354,400*	*5,571,913*	
25	0	255,844	255,844	137,520			*393,364*	-19,046	-10,158	0	-3,500		*360,660*	0	0	0	*360,660*	*5,932,573*	
Totals			*6,396,090*	*2,035,112*	*0*	*0*	*8,431,203*	*-423,648*	*-225,946*	*0*	*-87,500*	*0*	*7,694,109*	*-495,198*	*-1,266,339*	*-1,761,536*	*5,613,328*		

 Version 9.1.7

Basic Input Values

(input in GREEN cells only)

FOCUS©
Wind Site Evaluator

Site Information:	*St. John's Prep*		
Owner Name:	St. John's Prep		
	72 Spring Street		
	Danvers		MA
Latitude	42.58370	Longitude	-70.59890

Facility:				
Select the Wind Turbine Desired:	AW54-750		1	No. of Turbs
If 'Other' selected, name:				
Wind & Environmental				
Ave. Wind Spd (m/s):	6.1	Corrected Speed:	6.19	m/s
Hub Height (m):	65	Meas. Hgt (m):	60	
Wind Shear Exp.	0.18	Weibull K Factor	2	
Availability Loss	93.00%	Safety Margin Loss	3.00%	
Turb. Intensity Loss:	2.00%			
Alt. Above Sea Lev. (m)	15	Avg. Temp. (Deg.C):	10	

Project Costs:			*Sched.Date*
A. Turbine Costs:			
Turbine base cost (order date):		$1,250,000	
Shipping to site:		$105,000	
Duties and Fees:		$0	
Lighting, Lifts, cold weather pks, etc.		$10,000	
Other options:		$0	
Per turbine total from Mfgr:		**$1,365,000**	
Per turbine foundation design cost:		$15,000	
Per turbine foundation constr.cost		$100,000	
Total per turbine cost:		**$1,480,000**	
No. of turbines: 1	*Extended:*	*$1,480,000*	
B. Balance of Plant:			
B1. PreDev and Permitting			
Wind Studies:		$5,000	
Feasibility Study:		$5,000	
Site Plans:		$10,000	
Soil Geotechnic Study:		$3,500	
Interconnection Studies:		$7,500	
Noise Studies:		$2,800	
Flicker Studies:		$3,000	
Avian, Environmental Studies:		$0	
Road Surveys		$2,500	
Other:	PR	$5,000	
Legal:		$20,000	
Total (B1) PreDev and Permitting:		**$64,300**	
B2. Construction:			
Excavation:		$20,000	
Site and Road Upgrades:		$50,000	
Dewatering:		$5,000	
Electrical - Turbines to Grid		$80,000	
Grid Upgrades:		$23,000	
Turbine Wiring:		$25,000	
Erection team costs:		$100,000	
Cranes:		$100,000	
Storage costs:		$4,000	
Landscaping:		$15,000	
Commissioning (operational date):		$10,000	
Security and Details:		$2,000	
Other:		$50,000	*0*
Contingency:		$100,000	^Total Days from Order to Commission
Total (B2) Construction:		***$584,000***	
Total Bal of Plant		***$648,300***	
Total Installed Cost		***$2,128,300***	
Salvg Value (% of inst cost)	10.00%	$212,830	

Power Cost Assumptions:					
Percent of Power Mix: Retail vs. Resale					0% Retail
Value of RETAIL Electricity (BTM or NM):					$0.119 $/kWhr
Contracted Disc. over Current Price:					0.0%
Adjusted Retail Rate					$0.119 $/kWh
Escalate: (A or B, A is default if enetered.) A:					3.3%
B:	0.0%	0.0%	0.0%	0.0%	0.0% per term
(^ allows rates like: 4% inc. for 5 years, then 2% for next 5 years...)					
Value of RESALE (Merchant Electric sold to grid):					$0.150 $/kWhr
Resale escalator					0.0% per year
Value of RECs or Green Tags					$ 0.025 $/kWhr
Annual escalator					5.00%
Value of PTCs					0.021 $/kWHr

Expenses by Month

Land Costs (choose 1):	% of Gr. Elec. Rev.:	0.00% %GR (def)
	Payment/Turbine:	$0 $/mo/Turb

Month	O&M	Insurance	Land	Mgt Other	Financing
January		8,000	0	3,500	14,679
February			0	0	14,679
March			0	0	14,679
April			0	0	14,679
May	15,000		0	0	14,679
Jun			0	0	14,679
July			0	0	14,679
August			0	0	14,679
September			0	0	14,679
October			0	0	14,679
November			0	0	14,679
December			0	0	14,679
Totals	15,000	8,000	0	3,500	176,154

Total:			
$/kWhr	0.00879		
% of Inst. Cost/yr		0.38%	
$/Mo			291.6666667

Used in Annual Profroma:

O&M	0.00879 $/kWh based on Net Ann. Output
Land Cost	0 % of Rev unless 0, then $/turb
Mgt Fee:	$292 $/mo
Insurance	0.38% of Installed Cost/yr.
Inflation rate	1.00% per year (affects ann. costs)

Ownership and Financing Structure:

Type of Ownership	'S-Corp', LLC, Partnership			Fed Tax Credit type	CASH
Participants Tax brack:	50%			Apply Grants to:	FINANCING
Project Financed? (Y/N)	Y			Fed Tax Grant:	$542,717
Down Pmt	15%	Int. Rate	6.50%	Loan Term	10
Financed Amount:	$1,266,339			Tot. Invest. Capital	$319,245
		Disc. rate for NPV calcs			7.00%

Version 9.1.7

Annual Energy Generation Estimate

Estimated Turbine Power Output

FOCUS Wind Site Evaluator

Project: St. John's Prep

Selected Wind Turbine: AW54-750

Inputs	Automatic Values	Manual
Rated Power (kW)	750	
Rotor Diameter (m)*	54	
Swept Area (m2)	2290.22	
Avg Wind Speed (m/s)*	6.1	
Weibull k value	2	
Actual Weibull C if known		0
Weibull C (act or Vavg/.89)	6.953	
Anemometer Height (m)*	60	
Tower Height (m)*	65	
P-Value	50.00%	
Sigma	0.42	
Normsiv	0.00	
newVel	6.19	

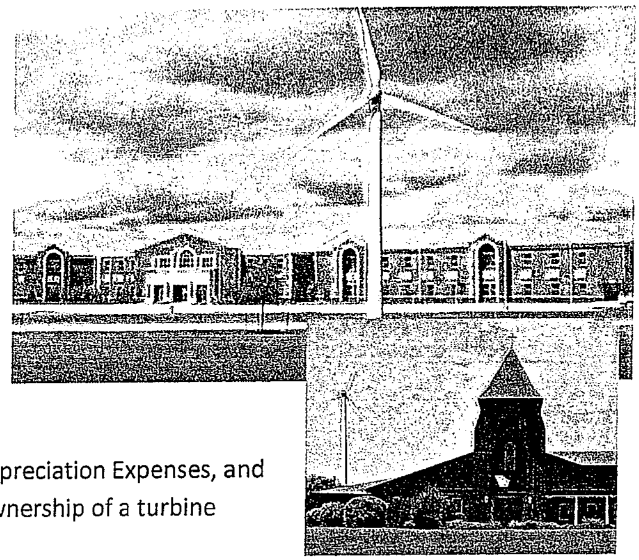
Output	
Hub Height Avg. Wind Speed (m/s)	6.19
Altitude Correction	1.00
Temperature Correction	1.02
Annual Energy Output (kWh) (incl. losses)	1,705,624
Avg Daily Energy (kWh)	4,673
Avg. Monthly Energy (kWh)	142,135
Avg. Power	220.24
Avg. Wind Energy Conversion Efficiency	0.35
Capacity Factor	0.26
Annual Specific Yield (kWh/m2/yr)	745

Wind Speed Bin (m/s)	Gross Wind Power (kW)	Turbine Power Curve (kW)	Effic. (%)	Corrected Turbine Power (kW)	Weibull Freq. Dist.	Turbine Power (kW) columns E*F	Hours/yr wind blows at this speed	Gross Wind Energy (kWhrs/yr)	Turbine Avg. Energy (kWhrs/yr)	Alt. Avg. Energy (input) (kWhrs/yr)	Act. Weibull Distribution
1	1	0.0	0.00	0.0	0.0405	0.00	355	498	0		
2	11	0.0	0.00	0.0	0.0762	0.00	667	7,488	0		
3	38	4.0	0.10	4.0	0.1030	0.41	902	34,185	3,632		
4	90	30.4	0.34	30.9	0.1188	3.67	1041	93,480	32,120		
5	175	72.6	0.41	73.8	0.1233	9.10	1080	189,459	79,704		
6	303	126.7	0.42	128.8	0.1179	15.18	1033	312,921	132,974		
7	481	211.2	0.44	214.6	0.1051	22.56	921	443,048	197,602		
8	718	324.7	0.45	330.0	0.0881	29.06	772	554,222	254,602		
9	1023	455.4	0.45	462.8	0.0697	32.26	611	624,588	282,617		
10	1403	598.0	0.43	607.7	0.0523	31.77	458	642,627	278,337		
11	1867	720.7	0.39	732.4	0.0373	27.28	326	609,397	239,017		
12	2424	750.0	0.31	762.1	0.0253	19.25	221	536,365	168,616		
13	3082	750.0	0.24	762.1	0.0163	12.43	143	440,504	108,919		
14	3850	750.0	0.19	762.1	0.0101	7.66	88	338,973	67,106		
15	4735	750.0	0.16	762.1	0.0059	4.51	52	245,205	39,467		
16	5747	750.0	0.13	762.1	0.0033	2.53	29	167,183	22,172		
17	6893	750.0	0.11	762.1	0.0018	1.36	16	107,669	11,905		
18	8182	750.0	0.09	762.1	0.0009	0.70	8	65,615	6,112		
19	9623	750.0	0.08	762.1	0.0004	0.34	4	37,895	3,001		
20	11224	750.0	0.07	762.1	0.0002	0.16	2	20,767	1,410		
				Total	0.9964	220.24		5,472,086	1,929,312	0	0.0000

Social Investing in Churches and Other Non-Profits –
Sponsoring a Wind Turbine: The Gift That Keeps Generating Revenues

By matching Non-Profit organizations with Benefactors who donate toward the cost of a wind turbine, the organization receives an unrestricted cash flow of many times the donation value itself for 25 years, and the donors can recoup all of their money through tax write-offs.

Brian D. Kuhn, VP Development, Aeronautica Windpower, LLC, Plymouth, MA



Did You Know:

- Churches, Private Schools, Private Hospitals, and many more '503' non-profit groups derive much of their income from donations by Benefactors. These organizations are constantly seeking additional funding to expand worthwhile programs.
- Many such organizations are located on large grounds that can easily accommodate wind turbines. The organization can use the valuable electricity generated themselves, or produce more than needed and sell the excess generation.
- Through a combination of special 'Investment Tax Credits', Depreciation Expenses, and Donation Expensing, a Benefactor who donates toward the ownership of a turbine project for the non-profit can recoup all of their money.
- A 225kW or 750kW commercial wind turbine is a perfect size for many of these facilities. Depending on the local price of electricity, renewable energy credits and other regulations, a single 750kW wind turbine can produce over $300,000 per year in revenue to the organization at current prices. A smaller 225kW turbine can produce over $100,000. That's a lot of bake sales!
- The cost of electricity is expected to rise much faster over the next 25 years as it did in the previous 25 years. Therefore the gift grows in value over time.
- Benefactors can make either an upfront capital contribution for the entire project, or over time by contributing to financing payments each month. A typical 225kW turbine costs about $800,000 to install, while the 750kW costs about $2M.
- Groups of donors (multiple benefactors) can combine to achieve the same purpose.
- While the donor's giving will stop as soon as the turbine project is paid for, the revenues to the organization continue to accumulate – for 25 years or longer. Thus the donor's gift is multiplied by several times.
- Wind energy is a clean, renewable, zero-emissions source of energy. It is the perfect social investment. A single 750kW turbine saves the equivalent amount of oil in a line of oil trucks over 3 miles long. And it saves over 1.5 metric tons of greenhouse gases – the equivalent amount of gas would fill an NFL football stadium – every year!

About Aeronautica Windpower, LLC:

Aeronautica Windpower is a Plymouth, Massachusetts based wind turbine manufacturing company. It produces and sells 225 and 750kW wind turbines for the commercial, industrial and community wind markets. It manufactures the only mid-scale wind turbines in the US, and is the ONLY wind turbine company certified to display the coveted 'Made-In-USA – Certified' label.

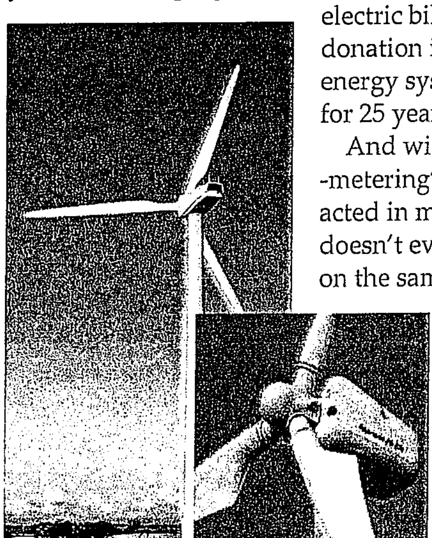
Aeronautica Windpower, LLC www.AeronauticaWind.com 11 Resnik Rd. Plymouth, MA 800-360-0132

Churches, Synagogues, Other Non-Profits...

Got Windy Properties?
You'll Never Need Another Bake Sale.

Whether You Provide The Benefactor Or We Do, A Wind Turbine Is A Gift The Just Keeps On Giving.

Did you know that there are benefactors that will donate wind turbines to Churches and other non-profits? We know many of them. You may even have some of these people in your own congregation. Sure, a donation to pay this year's electric bill helps—but that same donation invested in a renewable energy system keeps on giving for 25 years or more.



And with some of the new 'net -metering' regulations being enacted in many states, a turbine doesn't even have to be located on the same property as the church—it could be located across town or across the county!

So whether you have land available or not, or if you have an existing benefactor(s) or not, we can help.

The *Associated Wind Developer's Power Play*© program puts givers together with churches and other non-profits to obtain the benefits of sustainable wind generated power.

We take care of everything: permitting, design, construction, financing plans for donors (or investors) and operation of the equipment. We'll even provide operating, maintenance and management functions for you for years to come. We'll teach your donor or donor group about the many beneficial tax advantages they can enjoy.

Wind turbines are popping up everywhere these days. They've become icons of our desire to provide increasing stewardship of our planet. If your congregation decides to get involved you'll not only be generating valuable cash for programming and other ministries, but you will be contributing to the greening of America and the strengthening our local and national economies by lessening our dependence on foreign oil.

As you can imagine, a limited number of these opportunities and donors are available, and some important tax benefits run out after 2011, so act soon.

For full program details call us today.

awd
ASSOCIATED
WIND DEVELOPERS

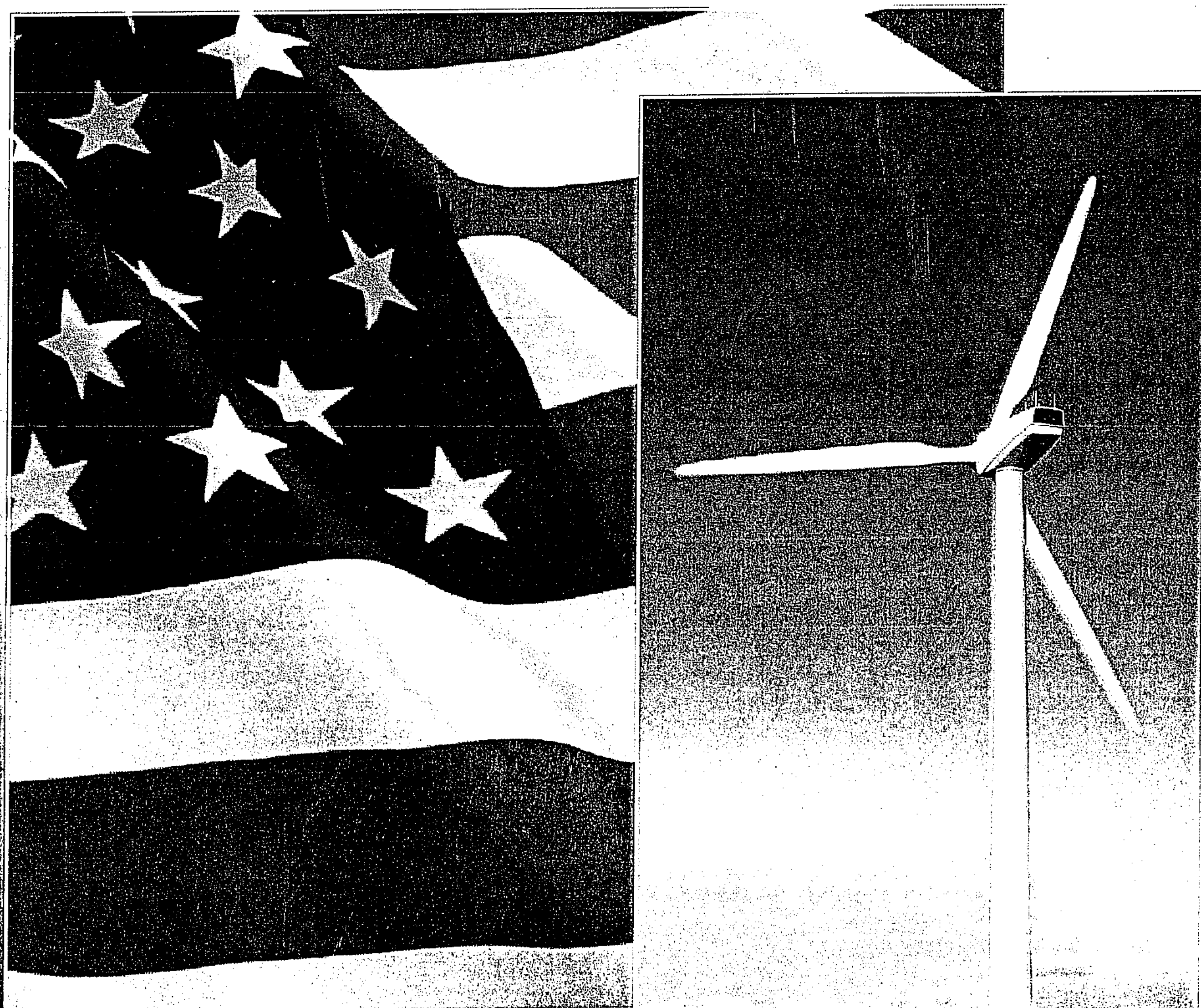
Associated Wind Developers, LLC
P.O. Box 6006, Plymouth, MA 02360
888-800-2381
www.AssociatedWindDevelopers.com

AERONAUTICA Windpower™

PRODUCT SPECIFICATIONS

Models

47—750
54—750



US-Built, Mid-Scale Electric Wind Turbine Generators

When King-Sized Turbines Are Just Too Large

In an age of King-sized wind turbines designed for wide open spaces, *Aeronautica Windpower* is proud to introduce the **750 Series**: Three-Quarter megawatt, 'Queen-size' machines designed for 'distributed wind' applications. Many good wind sites just cannot accommodate huge, utility-scale turbines. A large number of sites, especially around populated areas,are better suited to a sub-utility size machine.
The 750 is the perfect fit.

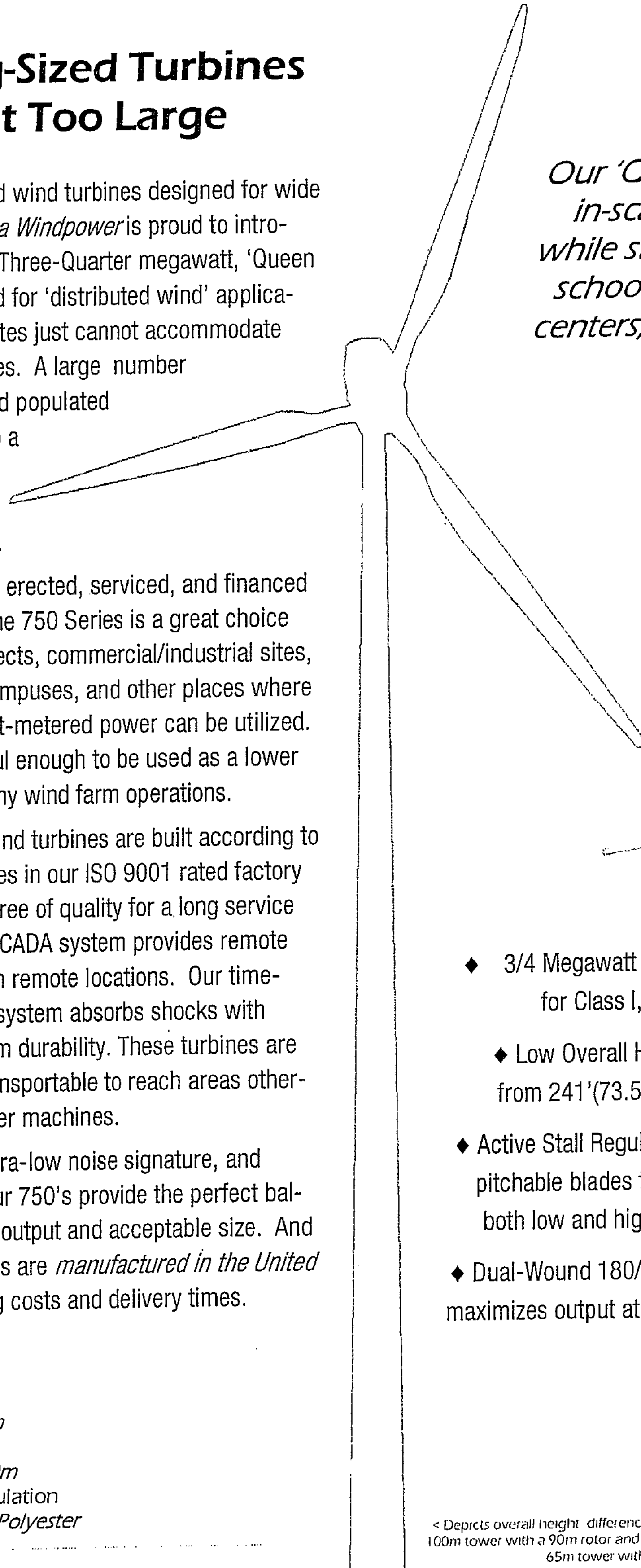
More easily permitted, erected, serviced, and financed than its larger cousins, the 750 Series is a great choice for community wind projects, commercial/industrial sites, college or high school campuses, and other places where 'behind the meter', or net-metered power can be utilized. Yet they are also powerful enough to be used as a lower height alternative for many wind farm operations.

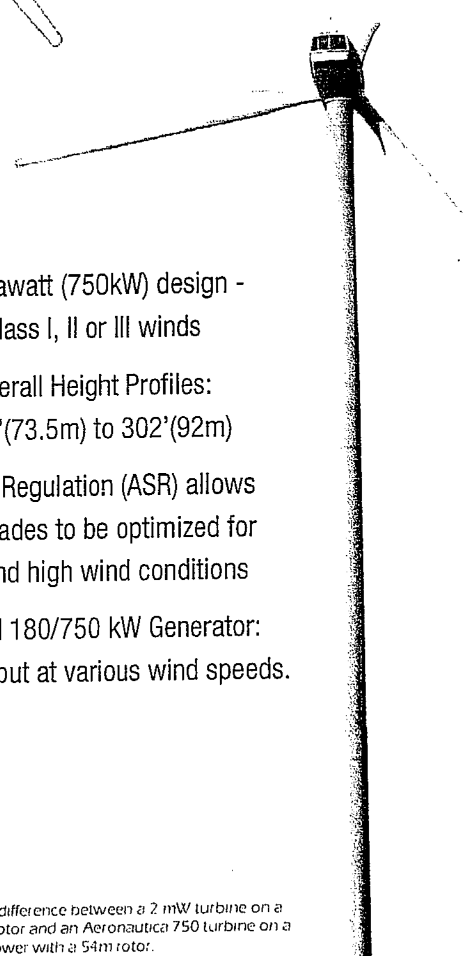
Aeronautica 750kW wind turbines are built according to strict IEC 61400 guidelines in our ISO 9001 rated factory to insure the highest degree of quality for a long service life. The Internet-ready SCADA system provides remote access and viewing from remote locations. Our time-tested gearbox isolation system absorbs shocks with ease, adding to long term durability. These turbines are ultra-quiet and highly transportable to reach areas otherwise inaccessible to larger machines.

With its low profile, ultra-low noise signature, and highly efficient output, our 750's provide the perfect balance between economic output and acceptable size. And *Aeronautica* wind turbines are *manufactured in the United States*, reducing shipping costs and delivery times.

Fast Facts:
Orientation: *Upwind*
Rotor Diameters: *47, 54m*
Rotor Speed: *~25.3RPM*
Hub Height: *65, 55 or 50m*
Pitching: Active-Stall Regulation
Blades: *Fiber Reinforced Polyester*

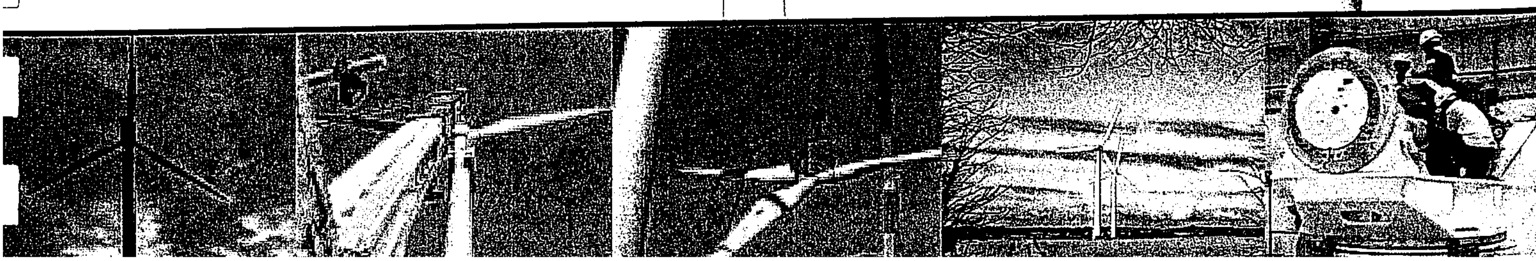
Our 'Queen-Size' turbines are more in-scale with local communities, while still providing lots of power for schools, industrial parks, shopping centers, neighborhood net-metering, wind parks and more!





- 3/4 Megawatt (750kW) design - for Class I, II or III winds
- Low Overall Height Profiles: from 241'(73.5m) to 302'(92m)
- Active Stall Regulation (ASR) allows pitchable blades to be optimized for both low and high wind conditions
- Dual-Wound 180/750 kW Generator: maximizes output at various wind speeds.

< Depicts overall height difference between a 2 mW turbine on a 100m tower with a 90m rotor and an Aeronautica 750 turbine on a 65m tower with a 54m rotor.



750 kW System Specifications:

Wind Class:
47m rotor: IEC Class Ib and IIA
54m rotor: IEC Class S (IIB-reduced wind stop) and IIIA

Blades:
3 blades, upwind orientation, Fiberglass reinforced polyester

Rotor:

Power regulation:	Pitching using Active Stall Regulation (ASR)
Rotor size:	47m, 54m diameter options
Rotor speed:	25.3 rpm nominal
Swept area:	47m: 1,735 m^2, 54m: 2,289 m^2
Tilt angle:	4°
Coning angle:	3.0° forward
Tip speed:	62 – 63 m/s at full load
Pitch bearings:	4-point ball bearings
Air brake, normal:	Pitch to -20°, actuated by the ASR system
Air brake, emergency:	Pitch to -85° fail safe, activated by hub accumulators
Nominal pitch speed:	7.5 °/sec
Mechanical brake:	Fail-safe type disk brake
Brake torque:	1.8 times of nominal torque (approx)
RPM max. value:	1920 (60 Hz), 1600 (50 Hz), on the high-speed shaft

Generator:

Nom. Electric Power:	180/750 kW (dual wound)
Generator:	Closed, Asynch. Induction, 4/6 pole DW, IP54 or 55
Generator speed:	1200/1800 (60 Hz) or 1000/1500 (50 Hz) rpm
Loss in generator:	3 - 4 % at nominal power dependent on type
Generator cut-in:	Thyristor controlled gradual cut-in
Grid connection:	690 v, 60 Hz (std) or 50 Hz

Certification:
47-750 : DNV for IEC 61400 Ed. 3 Class IB and IIA
54-750 : Certification Pending

Operational:

Yaw motors:	4 pcs. w/electrical brakes built in
Yaw brakes:	4 pcs. disk hydraulic brakes
Yaw bearing:	4-point ball bearing
Cut-in wind speed:	3-4 m/s, based on 10 min average
Cut-out wind speed:	47m: 25 m/s, 54m: 20 m/s, based on 2 min average
Extreme wind speed:	47m: 54 m/s, 54m: 60 m/s (50 yr extreme)
Controller:	CC Electronics (Mitsubishi PLC)
Operating Temp. Range:	-20C TO +50C (Hi and Low Temp. Options Available)
Noise:	100 dBA Sound Power (at Nacelle)

Weights:

Mass of blades: (3):	Approx. 16,000 lbs (7,200 kg)
Mass of nacelle:	Approx. 48,400 lbs (22.000 kg)
Mass of hub:	Approx. 17,600 lbs (8.000 kg)
Mass total, excl tower:	Approx. 81,200 lbs (36.909 kg)

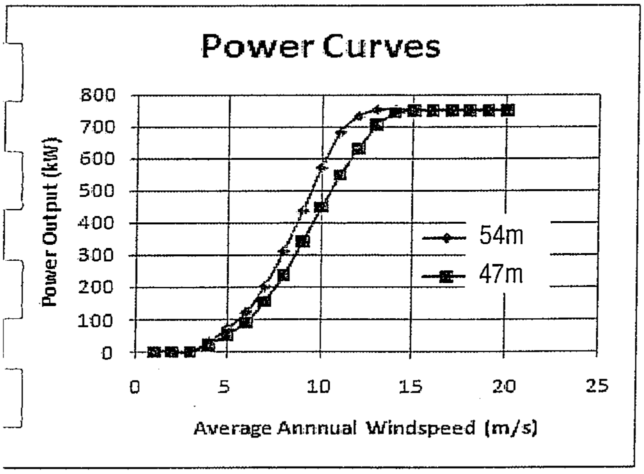
Monopole Tower

Construction:	Conical Steel, White, 65m and 50m towers available
Nacelle access:	Interior tower ladder through locked door
Surface treatment:	In accordance with ISO 12944
	Laser inspected flanges
	Ultrasonic inspection of raw materials and welds

SCADA:
Included in electrical cabinets at base of tower
Remote surveillance and operation via Internet or ADSL

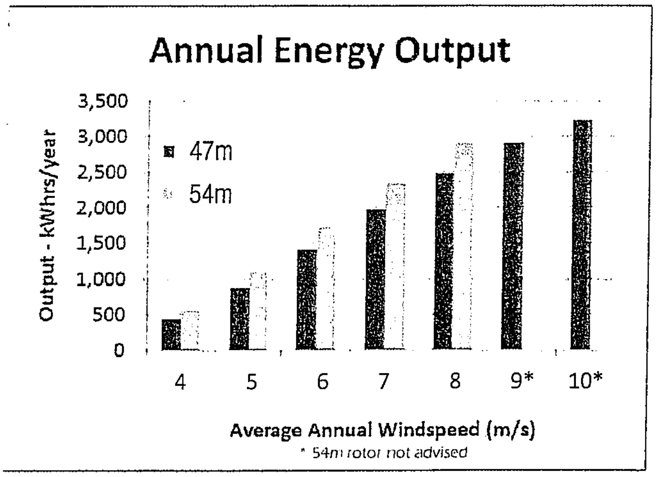
Safety:
Induction generator has inherent anti-islanding
Fail-safe hydraulic disk brake
Grid monitoring for shutdown and operational performance
Fall protection ladder system

Warranty: Two year standard warranty. Extended warranties available.

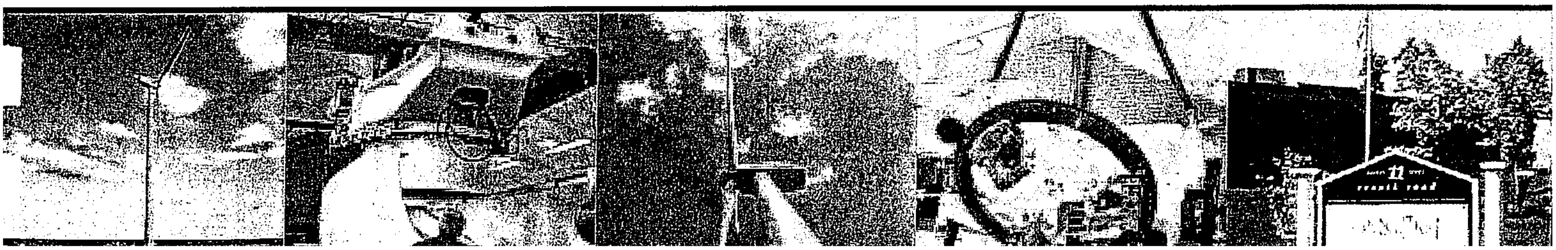


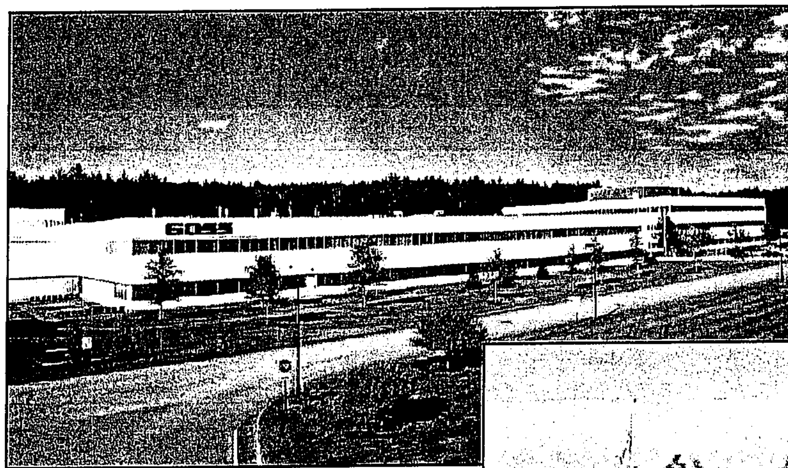
Power Table

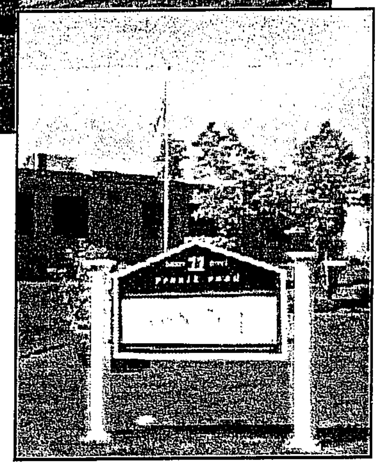
m/s	54m	47m
4	28	21
5	70	52
6	120	90
7	200	155
8	310	236
9	435	342
10	570	448
11	680	549
12	730	631
13	750	705
14	750	743
15	750	750
16	750	750
17	750	750
18	750	750
19	750	750
20	750	750



Power and Energy Curves shown are valid for 1.225kg/m3 air density, clean blades and undisturbed horizontal air flow. For the Energy Graph, a Rayleigh wind speed distribution and 100% availability is assumed
Power curve for 47-750 taken from DNV certification. Power curve for 54-750 is estimated, pending certification.







^ 500,000 sf Nacelle Manufacturing Facility at GOSS International, Durham NH

Main Headquarters, Plymouth, MA >

AERONAUTICA Windpower™

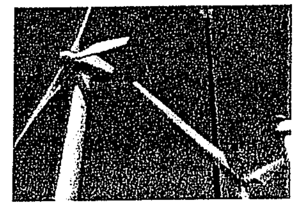
America's Wind Turbine Company

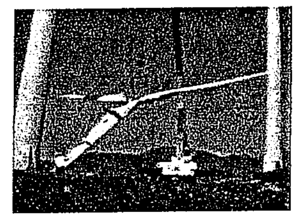
11 Resnik Road, Plymouth, MA 02360
1-800-360-0132
www.AeronauticaWind.com

NORWIN (Danwin) Product Line Reference List

norwin
Wind Turbine Technologies

Norwin (and our earlier *Danwin* label) Wind Turbines have been flying from as early as 1985. Our turbines were consistently rated highest in terms of Capacity Factor and In-Service Availability*.

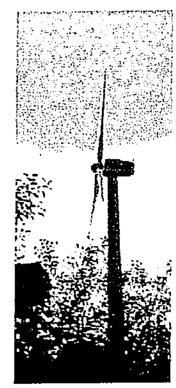




DANWIN 19
25 turbines installed in 1985 for FloWind Corporation, Altamont, California.
12 turbines installed in 1986 for private clients in Denmark

DANWIN 23/24
91 turbines installed in 1987 for K/S Viking Windfarms II, Tehachapi, California.
55 turbines installed in 1987 - 89 for private clients in Denmark.
21 turbines installed in 1988 for Danish utility NESA, Kyndby.
5 turbines installed in 1988 for utilities in Sweden.
60 turbines installed in 1988 for K/S Swanmill Windfarm I, Alta Mesa, California.
57 turbines installed in 1989 for K/S Swanmill Windfarm II, Alta Mesa, California.

NORWIN 24-150/200 kW
1 turbines installed in 1993 for private client in Denmark.
1 turbines installed in 1997 for private client in Denmark.
1 turbines installed in 1998 for private client in Denmark.

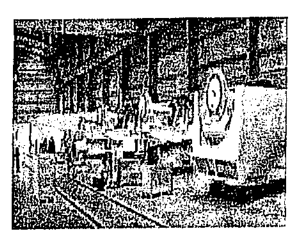


NORWIN 27-225 kW / 29-225 kW, WG 29 (GET/Danwin 27), DANWIN 27
1 turbine installed in 1999 for private client in Denmark.
1 turbine installed in 2001 for private client in Denmark.
3 turbines integrated in the Bahrain World Trade Centre (2007 - 2008)
1 turbine installed in 2008 for a private client in Dominica (the Caribbean)
1 turbine installed in California for McEvoy Ranch – May 2009
3 turbines installed in 1994, by GET mbH & Co KG for private clients in Germany.
10 turbines installed in 1995, by GET mbH & Co KG for private clients in Germany.
7 turbines installed in 1996, by GET mbH & Co KG for private clients in Germany.
4 turbines installed in 1989 for private clients in Denmark.
7 turbines installed in 1990 for Danish utility Elkraft on Bornholm.
4 turbines installed in Denmark in 1991, 3 for Danish utilities Elkraft and SEAS.

WG 37 (NEPC-Micon 37)
1 turbine installed in 1995, by NEPC-Micon Ltd in India.

WG 41-asr (GET 41) and WG 46-asr (GET 41a)
11 turbines installed in 1995, by GET mbH & Co KG for private clients in Germany.
9 turbines installed in 1996, by GET mbH & Co KG for private clients in Germany.

NORWIN 46/47-ASR-599/600/750 kW
1 turbine installed in November 1998, for Norwin A/S in Denmark as research turbine.
1 turbine installed in November 1998, for private client in Denmark.
1 turbine installed in November 1999, for private client in Germany.
1 turbine installed in January 2000, for private client in Denmark.
1 turbine installed in December 2000, for private client in Germany.



NORWIN 47-ASR-750 kW
14 turbines installed in 2005 in India, by NEPC India, Ltd.
2 turbines installed by Global Wind Power Ltd.
14 + 40 turbines under construction by Global Wind Power Ltd. in India
20 turbines under construction by Golden Lucky in China

NORWIN 9-15 kW
3 turbines under development for installation in Castle House London in 2009

Total (February, 2009) - 489 turbines.

AERONAUTICA Windpower

*source: California Wind Project Reporting System. In the early 1990's the Danwin label became the Norwin label. Both 225kW and 750kW Norwin Wind Turbines are now manufactured under license in North America by Aeronautica Windpower, LLC., Plymouth, MA.

www.AeronauticaWind.com
800-360-0132

11 Resnick Road
Plymouth, MA 02360
888-360-0132 (v&f)
www.AeronauticaWind.com