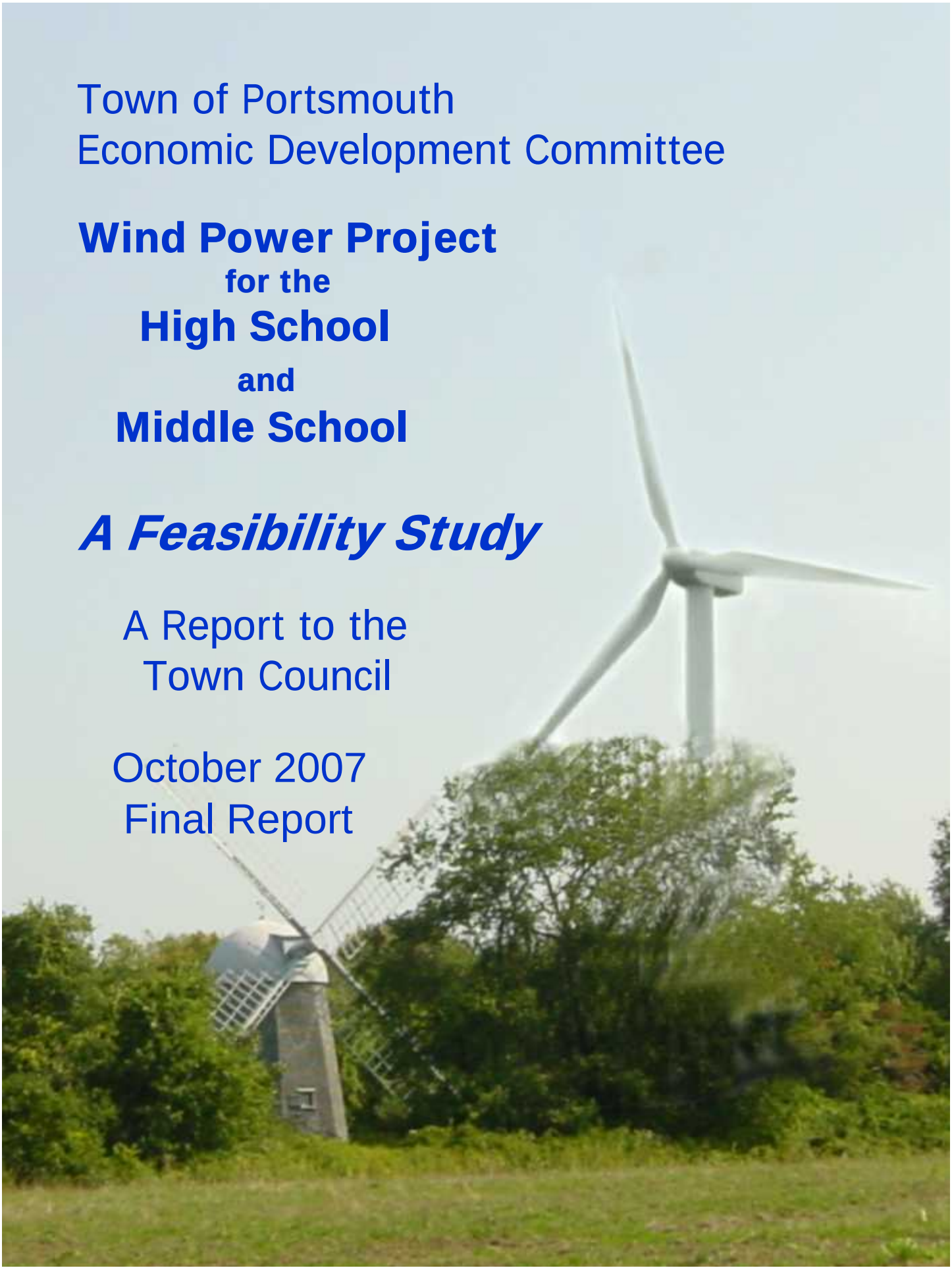
Town of Portsmouth
Economic Development Committee

Wind Power Project
for the
High School
and
Middle School

A Feasibility Study

A Report to the
Town Council

October 2007
Final Report



TOWN OF PORTSMOUTH
ECONOMIC DEVELOPMENT COMMITTEE
2200 EAST MAIN RD • PORTSMOUTH, RHODE ISLAND 02871

October 8, 2007

To: Town Council, Town of Portsmouth

Subj: Wind Project Feasibility Study

The Portsmouth Economic Development Committee (PEDC) has completed its Wind Power Feasibility Study. The final study report is enclosed.

The attached *Wind Project for the High School and Middle School - A Feasibility Study* represents the culmination of over two years of volunteer effort that, we believe, is a thorough, comprehensive and balanced representation of the Wind Turbine Project.

We appreciate the comments support of the Town Council expressed during the October 1, 2007 workshop and the resolutions passed supporting our project. The enclosed final study report incorporates comments from the workshop.

For the Committee,

Richard W. Talipsky, Chair

Enclosures: Study Report, Study Report Appendices

Copy to: with hard copy Appendices: Town Councilors (7), Town Planner, Town Administrator, State Energy Office (1), Superintendent of Schools, School Committee (Chair)
Copy to: with CD-ROM Appendices: School Committee (6), PEDC Members, Town Clerk, RI State Energy Office (1)

A copy of the entire report is available at www.portsmouthRIenergy.com .

Town of Portsmouth
Economic Development Committee

Wind Power Project for the High School and Middle School

A Feasibility Study

A Report to the Town Council

October 2007

(Final Report with comments from the 1 October Town Council Workshop)

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Executive Summary

This feasibility study was conducted in order to provide the Portsmouth Town Council detailed information on which to base their decision to proceed with a project to build wind turbines at either or both of the Middle and High Schools. In summary, the results of our efforts, using worst case analysis, show the following.

Turbine and Site	NPV at yr 20		Positive Cumulative Cash Flow (yr 1-20)?	Positive Annual Cash Flow (yr 1-20)?	Estimated Installed Cost*
	P-50	P-90			
GE 1.5 mW Middle School	$3.23 M	$2.47 M	YES	YES	$3.3 M
GE 1.5 mW High School	$2.66	$1.96 M	YES	YES	$3.3 M
FL 600 kW Middle school	$0.66 M	$0.25 M	YES	Exc years 3-12	$2.1 M
FL 600 kW High School	$0.44 M	$0.14 M	Exc years 5-15	Exc years 3-12	$2.2 M

P-90 - Average for which 90% of the values are greater.
P-50 - Average for which 50% of values are greater.
GE- General Electric, **FL** - Fuhrländer
NPV - Net Present Value (i.e., value after all capital, installation and operating costs)
***** Estimated Cost has a 10% contingency built in.

The PEDC recommends that the Town conduct the referendum authorized by State law and approve construction of a 1.5 mW wind turbine at the Middle School.

Background. In December 2004 the Portsmouth Economic Development Committee (PEDC) initiated steps to see if the use of wind power would be a revenue generator for the Town. The PEDC formed a Sustainable Energy Subcommittee that verified that wind energy was the best near-term technology to pursue.

Seizing upon emerging programs to assist communities to develop "green power" alternatives the PEDC secured both a $25K grant from the State and a Federally sponsored option to issue $2.6 million in zero interest Clean Renewable Energy Bonds (CREBs) for a turbine project that specified constructing wind turbines at either or both of the High School and Middle School. The school project sites were chosen based on the fact that each school represents a significant portion of the Town's electrical consumption and the land is Town-owned.

Wind Resource and Economic Analysis Contract. Using part of the $25,000 grant, the Town contracted with an expert wind resources firm, Applied Technology and

Management (ATM), to conduct analyses that were critical to ensuring that there was sufficient wind resource to create a positive return on investment. ATM performed a detailed wind resource analysis, a detailed energy use analysis, an electrical interconnection assessment, and a financial analysis for both the High School and the Middle School. Within the scope of ATM's study, no fatal flaws were identified that would prevent the development of a wind turbine project. The base concept cases considered for turbines were (1) 600 kW or 1.5 mW at Middle School, (2) 600 kW or 1.5 mW at High School, or both. The ATM study shows that positive revenue over the life of the installation is achieved for all four cases considered in the study.

PUC and Other Regulations. Existing RI PUC regulations require power companies to buy back "green" power generated by private users at "wholesale" rates. This makes the economic model where the majority of the electrical energy is consumed behind a single electric meter (like either of the two schools) much more attractive. The school property is Town-owned, provides significant open space with minimal environmental impact and ample open space for staging and construction. Safety considerations included physical failure of major components, electrical safety and electromagnetic fields. All reviews indicated no harmful effects and any hazards from physical failure extremely remote. The construction will conform to all existing Town zoning ordinances except for a variance for turbine height, similar to that approved for the Portsmouth Abbey wind turbine. The wind turbine is expected to be within FAA regulations and an application for an FAA permit has been submitted.

Public Information and Opinion. The PEDC conducted an aggressive campaign to educate the Town Council and the public on the project. This included a workshop with the Town Council, establishing a sustainable energy web site, conducting a series of public forums, working with the print and visual media and conducting a survey of residents in proximity to the schools; a random sample and voluntary submissions (more than 75% of all respondents favored a wind generator at the Middle School and /or the High School). The Town also requested and received authority from the State to conduct a bond referendum to gauge voter approval of the project (House bill 5217 / Senate bill 260).

Conclusions. This PEDC wind energy project study concluded the following:

a. Physical Siting

- The turbine installations proposed meets physical and electrical construction requirements

- The location of the turbines at each site provides optimum location considering wind resource and proximity to the school and abutting properties. Some residences (e.g., on the opposite side of the Middle School) fall within the 1036 foot proposed zoning circle.

b. Community Issues

-Based upon our public workshops and surveys of individuals in the community there is overwhelming positive support for the project. There is a very small amount of negative reaction. Most people feel well informed on the wind project.

c. Environment and Health

- There are no health hazards or risks associated with the turbine project above those associated with the current electrical supply systems at either school.

- The wind turbines will not adversely affect the environment.

d. Permitting

- The turbines will conform to existing zoning regulations, except that a variance will be required for the turbine height.

- Authorization from the FAA has been submitted for the Middle School site. The request is pending.

e. Wind Resources and Economics

- *Positive Economic Return* - Based upon a worst-expected case analysis, there is sufficient wind at the project site to support generation of wind turbine power with a positive economic net present value over the lifetime of every case postulated.

- *Compelling Evidence for the Middle School Site*. **The economic analysis associated with the construction of a 1.5 mW turbine at the Middle School is the clear best investment case that is expected to return over $3 million to the Town over its minimum expected life.**

- *Further Potential Economic Enhancements.* The following potential scenarios will further *enhance* the positive return on investment.

- Any increase in electricity cost above the conservative predictions used in the analysis.

- Legislation that improves the rate of return on power supplied to the electrical grid.

- Any years beyond the minimum expected 20-year life the turbine is in operation.

- Any enhancements the Town makes to increase power consumption behind the electric meter during times of excess generation capacity.

Recommendation: The PEDC recommends that the Town conduct the referendum authorized by State law and approve construction of a 1.5 mW wind turbine at the Middle School.

A workshop with the Town Council was held on October 1, 2007 that focused on the "next steps" beyond the voter referendum based on the two possible results: voter approval or voter rejection. While we are confident that the voters will agree with our recommendations we will endeavor to present clear options for both cases. At that workshop, the Town Council unanimously resolved to support the PEDC's recommendation.

Acknowledgements

The following members of the PEDC Sustainable Energy Subcommittee contributed significant volunteer efforts to this project.

Gary Gump - Chairman
Bob Hamilton
Steve Lake
John Palmieri
Doug Smith
Rich Talipsky

A special thanks to the people of the Portsmouth Abbey for their support. Brother Joseph Byron and Paul Jestings have been invaluable in providing advice and support based on their wind turbine knowledge. The Abbey's support for our wind energy public forums made them particularly effective.

The PEDC wishes to acknowledge the following organizations and individuals for their support and the expertise and generosity of time they provided.

- Bill Saslow and the Raytheon Company
- The RI Energy Office, especially Commissioner Andy Dzykewicz and Program Manager for Renewables, Julie Capobianco.
- Town of Portsmouth officials Dave Faucher, Bob Gilstein, Gary Crosby and Madeline Pencak
- Town of Portsmouth School Committee, especially Terri Cortvriend
- Portsmouth School District, especially Dr. Susan Lusi
- Roger Williams University School of Architecture graduate students and especially Dr. Lefteris Pavlides
- University of Massachusetts Renewable Energy Laboratory especially Sally Wright
- Advanced Technology and Management, especially Dan Mendelsohn and Deborah Crowley
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- Jim Sweeney of Sustainable New Energy
- Henry DuPont of Lorax Energy
- American Wind Energy Association
- TrueWinds
- The Rhode Island Wind Alliance
- Anna and Mary Lake and Jan Gump

Wind Power Project for the High School and Middle School *Feasibility Study*

A. Introduction

1.Background

In Late 2004 the Portsmouth Economic Development Committee (PEDC) took its first major steps in determining if wind power could be a realistic economic generator for the Town. After reviewing the principles of various methods of renewable energy sources the PEDC formed a Sustainable Energy Subcommittee to coordinate the review of various methods of renewable energy that could benefit the Town. Becoming more "sustainable" in energy in the Town (i.e., working towards goal of being able to meet all its energy needs without the need for obtaining power from outside sources) would require not only the use of renewable energy sources (such as wind, water current and the sun) but, also require energy conservation. (See Appendix A for renewable energy basics, alternative energy cost and sustainable energy comparisons.)

The subcommittee quickly came to the conclusion that, although there were many potential sources of renewable energy, wind power was the most viable near-term method to help the Town with its energy needs while creating a positive revenue stream. Anecdotal data indicated that Portsmouth has sufficient wind to make wind power production economically feasible and many legislative acts were being enacted to support renewable energy projects. Thus, the Portsmouth Wind Power Project was born.

To seize upon the many emerging programs to assist in the evaluation and funding for renewable energy, the PEDC had to act quickly to secure the opportunities. Two significant opportunities presented themselves in 2006 and the proactive work of the PEDC allowed us to capitalize on them

· Rhode Island State Energy Grant - The Rhode Island State Energy Office issued a Request for Proposals in March 2006 to award grants of up to $25,000 to conduct feasibility studies for renewable energy projects. The Town submitted a proposal and was awarded a $25,000 grant.

· Clean Renewable Energy Bond (CREB) - July 2005, Congress passed the Energy Tax Incentives Act of 2005, which provided for the issuing of no-interest bonds (called CREBs) for renewable energy projects via the Internal Revenue Service (IRS). In April 2006 the Town applied for one of these bonds and was awarded authorization to issue up to $2.6 million in CREBs for the Town's wind project. Since the application for the bond required the submission of a specific project, the Town's project specifications was for construction of wind turbines at either or both of the High School and Middle School.

The Town has been working with both the State Energy Office and other Rhode Island communities to leverage their knowledge and resources. We have positioned the Town ahead of the effort of all other Rhode Island towns in wind power initiatives.

Since the PEDC established its sustainable energy subcommittee, a primary premise was that that any power production system create a positive return on the Town's investment, it conducted this feasibility study for a wind power project.

B. Project Description

The renewable generation project postulated was to install a wind turbine at one or both of two potential sites. The sites are (1) the Portsmouth Middle School and (2) the Portsmouth High School. These sites were chosen based on a preliminary analysis of electric consumption behind the meter, wind resource, land available for the installation, abutting properties and the potential for education value of the proximity of the wind turbine to the schools. Two sites were chosen for the study because of the economy of scale that could be gained from erecting wind turbines at two similar sites that are geographically close. Alternatively, the analysis would consider if constructing one large turbine at only one school would provided the best probability of return on investment. Proposing the constructing of turbines at one or both of the schools provided for the highest probability for award of a Clean Renewable Energy Bond (CREB). In the Town's application for the CREB, the Internal Revenue Service required a specific project and, in their awarding the bond authority to the Town, stipulated that the CREB could only be used for that specific project.

1. Project sites - Portsmouth Middle School and/or High School.

The Town of Portsmouth owns both the Middle School and High School sites. Each site provides a high percentage of the Town's electric load behind power meters to provide a greater probability of high return on investment based on current (2007) power distribution statutes. Both sites were reviewed for the best availability of meteorological data and other parameters applicable to the wind project.

a. Middle School Site - Site #1 is the Town Middle School and associated land located at 125 Jepson Lane and is situated on approximately 37-acre of town-owned land. The property is abutted by several residential areas with a large, 11-acre commercial site on the north side of the Mill Lane / Jepson Lane intersection. The school is near the RI Route 114 / Mill Lane intersection. The preferred turbine site is in the southwest corner of the school property. (See Figure 1).

Figure 1 - Middle School Site

Figure 2 - High School Site

b. High School Site - Site #2 - The Town High School and associated land is located at 120 Education Lane and situated on approximately 42-acres of town owned land. An additional 11 acres of Town property and several residential areas abut the property. It is near RI Route 24 near the Turnpike Avenue northbound on ramp. The preferred wind turbine location would be in the northwest corner of the school property. (See Figure 2)

C. Electrical Demand

1. Overview.

To provide a measure of the electrical demand for the project, we requested data from National Grid. (Refer to Appendix B for Town energy use and NGRID rates.) They provided us data in 15-minute increments for the period July 2004 thru June 2006 for both the High School and Middle School. This electrical demand was provided to the consultant (ATM) for use in the economic model. Data showed that each school consumed an average of about 1 million kWh (HS = 954,000 kWh, MS = 957,000 kWh) of power each year based on data provided by National Grid which represents approximately 35-40% of the total municipal energy use. An analysis of electrical demand is important because current regulations for energy distribution provide for a low value of energy produced and placed back on the electrical grid "outside the electric meter" (see Figure 3 below). Thus, better matching of wind turbine electrical capacity to "behind the meter" load enhances the economic model. Also, electrical demand does not always match the time when the wind turbine provides output. For example, wind tends to be higher in the late afternoon and evening, whereas school power demand is higher during the day as explained below.

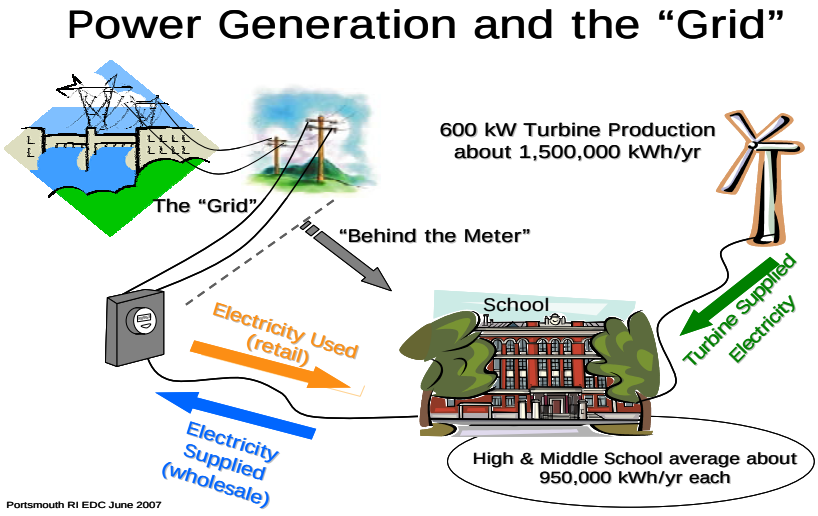

Figure 3 -Power Generation and the Grid

2.Power Distribution.

Current RI power distribution laws play a significant factor in determining the economic feasibility of a power generation facility. (See Figure 3). The power company provides power on an electric supply system (called "the grid"). Simply, the grid is anything outside an "electric meter". Suppliers that put electricity onto the grid sell it to the electric company at a wholesale rate. Users, that take electricity off the grid buy the electricity at a retail rate. The retail rate includes a number of charges for maintaining the electric lines and power generation infrastructure. (If you look at your electric bill, many of these charges are listed.) The "device" that measures all this is your electric meter. Under current RI law if you supply your electricity needs "behind your electric meter" (say, with a wind turbine) you provide yourself electricity at the equivalent of a wholesale rate. Whenever you need to draw electricity from the grid, you have to buy it at the retail rate. Since the Town has many electric meters, if we built a BIG wind turbine to supply the whole town, we would be continuously putting electricity on the grid (getting paid 'wholesale') and using it behind some other town electric meter (buying it back at "retail). That throws a "monkey wrench" into the economic analysis for building a wind turbine. See an illustration of this in Figure 4 where the power generated by a 600 KW wind turbine is compared to the usage of the High School on a "typical Wednesday" derived from average High School usage over the year.

One way to solve the problem is to have a wind turbine "behind a town electric meter" that exactly matches the demand eliminating the need to place power on the grid or take power from it. That is the basic premise of erecting a wind turbine at a school where the annual power demand is close to the turbine output. But, alas, the wind does not always blow when the peak electrical demand occurs and no cheap and effective "power storage" devices have been devised. So, even at a school, we are faced with continually putting power on the grid and taking power from it all day long. This does not help the economic value of wind turbines.

The next questions is, "Why not just let the meter run 'backward' when we put electricity on the grid and run 'forward' when we use electricity from it?" . This is called "true net metering". However, getting a total retail return on all power that is placed on the grid does not account for the power companies costs for maintaining generators and power lines to supply electricity when the wind turbine is not producing power. So, the power company does not want to pay full retail price for power placed on their grid. For several years, the State has been trying to pass some type of net metering legislation but has not been able to provide full relief to small renewable energy providers (like municipal wind turbines). The 2007 RI Assembly did pass a "watered down" net metering bill that will provide minimal relief to the Town.

Because small wind power projects are essential to the sustainable energy goals the rule-makers continue to work on schemes to provide wind turbine owners some relief in the amount of credit they get for putting power onto the grid. We expect some

additional legislative relief to provide more return on the electricity that our wind turbine places back on the grid.

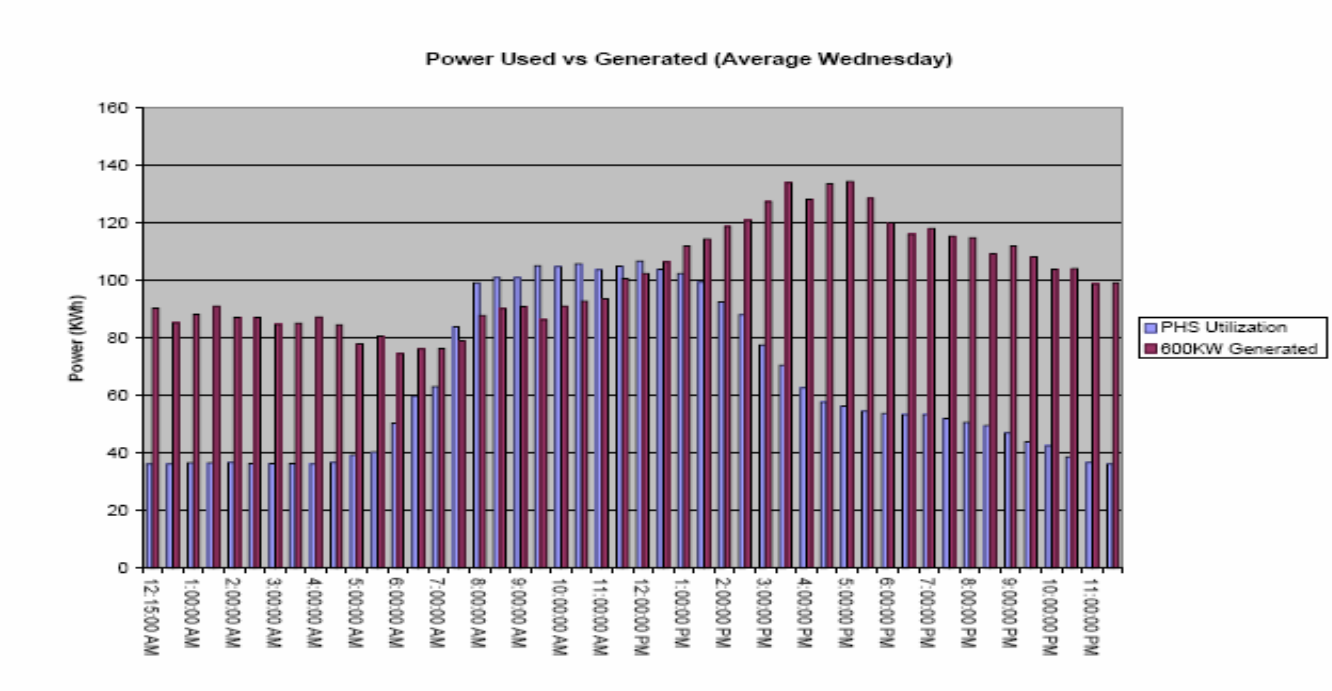

Figure 4 - An Average Wednesday - High School

D. Physical Site and Construction

To ensure the selected site was suitable for the project, we reviewed the environmental, and technical issues associated with the project. These included:

1. Site Ownership and Abutters - Maps characterizing abutting parcels by type and ownership are shown in Appendix C.

2. Environmental Impacts - Environmental authorities were consulted to ensure that the project presented no environmental impacts.

a. Physical Environment - Using school property that has been previously reviewed for environmental impact, there are no apparent physical environmental issues associated with the project.

b. Wildlife and Natural Heritage - USFWS and RI Natural Heritage Program queries revealed no wildlife of natural heritage impacts from the project

3. During Construction - The physical construction will pose no unique problems. Construction and staging areas can be managed using standard construction practices and areas (except for the immediate area around the turbine tower and newly-installed switchgear enclosures) will be returned to as good or better than pre-construction conditions.

4. Existing Electrical Infrastructure. Existing physical infrastructure and locations for electrical switchgear and transmission lines to the existing electrical distribution system. Details of the existing electrical switchgear and main electrical trunk connections are provided in Appendix C and summarized below.

a. High School - The main electrical service line connection enters the school property from Education Lane in the northeast corner of the property connecting to a pad mounted 500 KVA transformer approximately centered outside the east wall of the main school structure. The electric meter is located at the switchboard inside the building. Based on the recommended turbine site shown in Figure 1, the turbine electrical switchgear will be located at the base of the turbine tower with electrical transmission lines running underground to the network interconnection point.

b. Middle School - The main electrical service line connection enters the school property from Jepson Lane in the southeast corner of the property connecting to a pad mounted 300KVA transformer approximately centered outside the South wall of the main school structure. The electric meter is located at the switchboard inside the building. Based on the recommended turbine site shown in Figure 2, the turbine electrical switchgear will be located at the base of the turbine tower with electrical transmission lines running underground to the network interconnection point.

c. Electrical System Details - Each school is presently served from a 13.8 kV (high voltage) utility feed that is fed underground to a pad-mounted transformer. The transformers are 500 KVA (13.8kv / 120/208v) at the High School and 300 KVA (13.8kv / 277/480v) at the Middle School. Cables then run underground at the lower voltage into the main switchboard inside the school utility room.

d. Modifications. The new interconnection from the wind turbine generator will be from a step-up transformer mounted at the turbine base and fed underground to the National Grid Primary feeder interconnection point along the school/street right of way ahead of the existing utility transformer which is a typical installation with no external enclosure (i.e., a locked fenced-in area) to limit contact with the installation.

The existing National Grid (NGRID) revenue metering equipment for the High School and Middle School will have to be replaced with bi-directional (capable of measuring electrical power that flows in both directions) metering equipment that measures: (1) power supplied by NGRID to the school during periods when power consumption exceeds the wind turbine generation; and, (2) power supplied to the NGRID 13.8 kV distribution system during periods when the wind turbine generator production exceeds the consumption. In addition, a kWh meter will have to be installed at the output terminals of the wind turbine generator to measure energy production.

E. Standards and Codes and Personnel Concerns

1. Standards and Codes

a. International Standards for wind turbine generators - The American Wind Energy Association (AWEA) is the lead organization for the development of U.S. industry consensus standards in liaison with a variety of professional organizations. U.S. domestic standards must be compatible with international standards to assure U.S. wind turbines have full access to foreign markets. All of the U.S. and foreign-built turbines considered for Portsmouth meet the IEC 61400 wind turbine series of standards of the International Electroctechnical Commission (IEC).

b. Building codes - The design and installation of the electrical transmission system must meet the requirements of Rhode Island code. The Rhode Island State Building Code incorporates the International Building Code 2006 edition (SBC-3) and the National Electric Code (NEC) 2005 edition (SBC-5). The transmission installations will comply with these requirements.

2. Personnel Concerns

a. Physical Setbacks - The National Wind Coordinating Committee (NWCC) is a collaborative endeavor composed of representatives of electric utilities and their support organizations, state utility commissions, state legislatures, consumer advocates, wind equipment suppliers and developers, green power marketers, environmental organizations, and state and federal agencies. In 1998 the NWCC Siting Subcommittee published the first edition of the "Permitting of Wind Energy Facilities Handbook" to address wind generation siting and permitting issues. In 2002 they published a revised edition of the Handbook reflecting "extensive experience with wind project development in several regions of the United States since 1998". In addressing various siting concerns for "public health and safety" the Handbook states; "Setback requirements ... whether part of a formal regulatory process or self-imposed by project developers for operational considerations provide an adequate buffer between wind generators and consistent public exposure and access." The Portsmouth draft regulations for wind tower siting propose fall zone setbacks designed into the wind turbine sites for the unlikely event of catastrophic tower failure are 1.1 x rotor tip height.

b. Sound Setbacks - there is no definitive evidence of harm due to turbine sound above those for any other sound producing device or equipment. Using expected sound levels of turbines, the Portsmouth draft regulations for wind tower siting contemplate sound zone setback from any residential dwelling is 2.75 x rotor tip height. These are approximately 630 Feet for a 600 kW turbine and 1036 feet for a 1.5 mW turbine and are plotted on Figures 1 and 2.

3. Physical Concerns. Physical concerns include the potential for physical failure of the tower, the blades or the elements inside the nacelle, the potential for the turbine blades slinging ice in cold weather, noise and electrical hazards and effects.

a. Physical failure of the tower. The turbine tower is designed to withstand the most severe weather conditions including hurricane force winds in excess of 150 mph. The remote turbine placement with the stated setbacks will be such to minimize the contact of any part of a failed turbine tower to any surrounding physical structure.

b. Failure of blades and/or elements within the nacelle. Since the rotational speed of the turbine blades is so slow (about 30 rpm) that blade failure will result in the blades falling in close proximity to the turbine and within the stated setbacks. The failure of an element within the nacelle are extremely rare and would probably result in seizure of components rather than disintegration of the rotational generator elements.

c. Ice slinging. In the rare event that ice buildup on the blades breaks away, the ice would not be thrown far due to the low rotational velocity of the blades. The stated setbacks provide protection from this hazard.

4. Electrical Safety Including Electric and Magnetic Field (EMF) Effects

a. Electrical Hazards - Electrical hazards are mitigated by compliance with the International standard IEC 61400 and the State Building Codes. Additionally we reviewed the extensive database of state school facility guidelines. contained on the website of the National Clearing House for Educational Facilities (NCEF) . A review of this database has developed the following school related requirements for electric distribution contained in the "State of New Jersey 21st Century Schools Design Manual" that can have application to the wind turbine project:

- Electrical Distribution Systems 1.3.d.2.j- Electrical underground feeders shall be encased in concrete with a minimum cover of 2 feet- 0 inches."

- Electrical Distribution Systems 1.3.d.2.m- Panels shall be in locked rooms.

b. EMF setbacks - In our initial presentation to the Town Council on the wind turbine project in April 2006 we were questioned concerning the possible effects of electric and magnetic fields (EMF) on the school population. The following is a summary of the results of our investigation. We have identified no quantifiable EMF risk to the school population from the proposed wind turbine installations. Electric and magnetic fields (EMF) are invisible lines of force that surround any electrical device. All alternating current power lines, electrical wiring, electrical generating equipment and any electric appliance operating at 60 Hz (cycles per second) power (like powered from the receptacles in a home) produce EMF including things such as fans, air conditioners, Washing machines, and electric dryers, etc. (See appendix A for links to other information.)

High voltage produces strong electric fields, while sources with strong currents produce high magnetic fields. The strength of both electric and magnetic fields weaken with increasing distance from the source (i.e. "setbacks"). EMF is not identified as a "public health and safety" concern in the aforementioned "Permitting of Wind Energy Facilities Handbook". The State of Rhode Island has no setback requirements separating school facilities from electric generation and transmission facilities.

The California Department of Health Services and the Public Health Institute have collaborated on a joint project the "California Electric and Magnetic Fields Program" to measure and identify possible effects on human health (http://www.dhs.ca.gov/ps/deodc/ehib/emf). While the studies have been inconclusive as to identifying if there is a health risk, the California Department of Education requires minimum distances between new schools and the edge of transmission rights-of-way. The setback guidelines start at 100 feet for 50 kilovolts – 133kilovolts (high voltage) lines. There are no setback requirements for lower voltages. This threshold voltage for setbacks (50 kilovolts) is 4 times that of our wind turbine generator and its buried transmission line (13.8KV), and the setback requirement is less than we have proposed for other considerations. In other words, we better this requirement even though it does not apply to the medium voltage of a wind turbine installation

5. Construction staging and layout areas

a. During foundation construction, a fenced hard-hat construction area will be required in the surrounding area of the turbine site. Access will be required for heavy construction equipment.

b. Following foundation construction and before turbine erection the immediate area of the foundation will be fenced to prevent damage to equipment and personal injury.

c. During turbine erection temporary staging areas for major turbine parts will be required over a two to three day period.

d. Delivery paths and cranes locations for erection. The time of delivery of major turbine parts, crane staging, and actual turbine erection will have to be closely coordinated to minimize impact on other activities as well as minimize the time expensive erection services are needed. Separate major parts expected to be delivered are the turbine nacelle, the tower (in several sections), turbine blades, and switchgear. This will require coordination of local and state authorities from point of delivery (port of entry or US vendor location), surveillance of transportation routes to minimize disruption of normal traffic flow, mapping traffic routes to the site to ensure there are no obstacles and that turn radii are acceptable, and insuring the crane and installation personnel are ready at time of delivery.

F. Zoning and Siting Regulations and Permits

1. Zoning Regulations - Town-owned property does not have to comply with zoning regulations. However it is recommended that we comply with zoning regulations to the fullest extent possible

2. Permits

a. Construction - The normal permitting process for construction in the Town will be followed by the selected contractor.

b. Transportation - No hazardous cargo is anticipated to be required. However, any special permits for conveying large turbine parts over public highways will be the responsibility of the transportation company

c. Special Use - Although town-owned property does not require a permit, the precepts of the Portsmouth's Zoning Ordinance (Article VII), should be considered . Normally, when the Town issues a special use permit, these include, but are not limited to the following:

- The desired use will not be detrimental to the surrounding area.
- It will be compatible with neighboring land uses.
- It will not create a nuisance or a hazard in the neighborhood.
- Adequate protection is afforded to the surrounding property by the use of open space and planting.
- Safe vehicular access and adequate parking is provided.
- Control of noise, smoke, odors, lighting and any other objectionable feature is provided.
- Solar rights of the abutters are provided for.
- The proposed special use will be in conformance with the purposes and intent of the comprehensive plan and the zoning ordinance of the Town.
- The health, safety and welfare of the community are protected.
- It is consistent with the purpose of design standards set forth in Article IX, Section D of Portsmouth Zoning Ordinance. (See Appendix C)

A copy of the Special Use Permit application submitted to the Town for the Portsmouth Abbey wind turbine and the Special Use Permit issued are provided in Appendix C.

3. Variance. A variance will need to be obtained for because the turbine's height exceeds the Town maximum height for structures. This would be similar to the variance granted to the Portsmouth Abbey for their turbine installation.

4. FAA Regulations

Siting rules are covered in FAA Regulations Section §77.13 Construction or alteration requiring notice (See Appendix A). FAA Form 7460-1 is required to be submitted at least 30 days prior to the earlier of (1) date construction is to begin or (2)

date an application for the construction permit is to be filed. The Form requires a description of the locations, information on the exact location of the wind turbine, distance and direction from the nearest airport, site elevation, overall height, and any previous Aeronautical Studies. The PEDC has submitted an FAA Form 7460-1 for the most limiting case of a 1.5 mW turbine constructed at the Middle School. A copy is provided in Appendix C.

Requirements for marking and lighting are covered in FAA Advisory Circular 70/7460-1K, Obstruction Marking and Lighting, (Reference C).

G. Base Concept Cases

Working with our support contractor, we reviewed and analyzed the potential base cases for turbines. Based on the preliminary work and the CREB application that set the site as either or both of the schools, we looked at the best available turbines to match power demand. There was also an economy of scale that was considered for (1) erecting one large turbine at one school instead of one at each school and (2) erecting two turbines at the same time to save delivery and crane charges. The final base cases used for the study were:

- FL 600 kW @ Middle School
- GE 1.5 mW @ Middle School
- FL 600 kW @ High School
- GE 1.5 mW @ High School

H. Wind Resources and Economics

1. Overview - Since wind resources drive the economic modeling, they are discussed together in this section. The PEDC determined that it was so important to get the wind resource picture and resulting economic model as accurate as possible, we used the majority of the State grant money to contract these issues out to the experts. A Request for Proposals was issued and the Town chose ATM (Applied Technology and Management) as the best consultant to provide a wind resource and economic analysis. ATM's full report is provided in Appendix E.

The ATM work included:

- a detailed wind resource analysis,
- a detailed energy use analysis,
- an electrical interconnection assessment, and
- a financial analysis

Within the scope of ATM's study, no fatal flaws were identified that would prevent the development of a wind turbine generator project.

2. Wind Resources. Wind resource is the major driver of the economic model and although there was much anecdotal and near-by data that indicated sufficient wind

for the project, it was important to get the best estimate of wind resource at the proposed sites. The Town contracted with ATM to perform a wind resources analysis to gather and correlate wind data from existing sources and provide the best prediction of wind resources at the selected potential sites. ATM used accepted modeling techniques and gathered historical data from a number of local sites including the Portsmouth Abbey wind turbine, meteorological data from Newport State Airport, a temporary meteorological tower at the Portsmouth Raytheon facility and data purchased from AWS Truewind. The output power of a wind turbine varies directly with the cube of the wind speed; a small difference in wind speeds is significant.

The result of the wind resource study showed that the wind resource is greater at the Middle School than the High School. Average annual wind speed is 7.08 meters per second (m/s) and 6.74 m/s at the Middle and High Schools, respectively. Capacity factor depends on the size of the turbine installed and ranges 29% to 31% at the Middle School and 26% to 28% at the High School.

Middle School Wind Speeds (meters per second (m/s))
- 80 meter tower
  - Low (August) 6.0 m/s
  - High (January) 8.05 m/s
- 50 meter tower
  - Low (August) 5.55 m/s
  - High (January) 7.45 m/s

High School Winds Speed (meters per second (m/s))
- 80 meter tower
  - Low (August) 5.7 m/s
  - High (January) 7.7 m/s
- 50 meter tower
  - Low (August) 5.25 m/s
  - High (January) 7.1 m/s

The wind resource data was used to determine P-90 (the average for which 90% of the values are greater) and P-50 (the averages for which 50% of the values are greater) probability estimates to be used as an input to the economic model.

3. The Economic Model. The most important product of the study was to determine if the project would provide a net return on investment both on an annual basis and for the entire —cradle-to-grave life of the turbine.

a. Costs - These costs include:

- Operating Expenses
  - · pre-installation development costs (e.g., permitting, preliminary engineering services, electrical interconnection studies and legal services)
  - · construction costs

· operation and maintenance costs
· decommissioning and disposal

- Cost of financing - that is, any administrative costs to secure a loan and interest on money borrowed.

b. Revenues - The turbine will produce several positive revenue streams that offset costs. This Market Value of Production includes:

- Wholesale Electricity Production - that power 'sold' to the power company as excess production. (predictions range from $79.45 per mWh in 2008 to $97.55 per mWh in 2027)

- Avoided Retail Electricity Charges - that power used 'behind the electric meter' that avoids having to be purchased from the power company. Predictions range from $127.57 per mWh in 2008 to $169.91 per mWh in 2027.

- Renewable Energy Certificates (RECs). RECs are certificates accrued by 'green' energy producers that are marketed to large entities (e.g., industries) to help them meet renewable energy goals. A conservative assumption that REC prices will decrease as the incentive for construction of renewable energy sources becomes less needed. Predictions range from $57.49 per mWh in 2008 to $23.26 per mWh in 2027.

c. Analysis. Figures 5, 6, 7 and 8 and Table 1 show the cash flows for the four postulated cases.

Case A - FL 600 at the Middle School shows a cumulative positive net cash flow over the entire turbine life and a NPV (Net Present Value) at year 20 of $655,000. However, during years 4 through 11 there is a negative annual cash flow of between $3000 and $11,000)

Case B - GE 1.5 at the Middle School shows a cumulative positive net cash flow both annually over its entire life and a NPV at year 20 of $3,233,000.

Case C - FL 600 at the High School shows a positive net cash flow for only some periods over its life and a NPV at year 20 of $440,000.

Case D - GE 1.5 at the High School shows a positive cash flow both annually and over its entire life and a NPV at year 20 of $2,664,000.

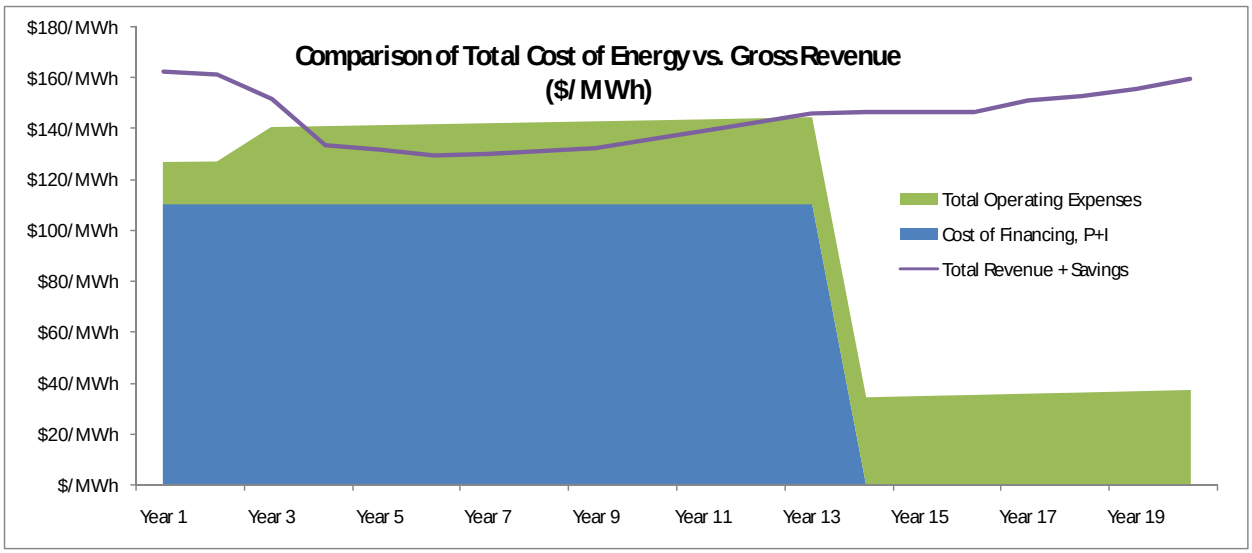

Figure 5 - 600 kW - Middle School

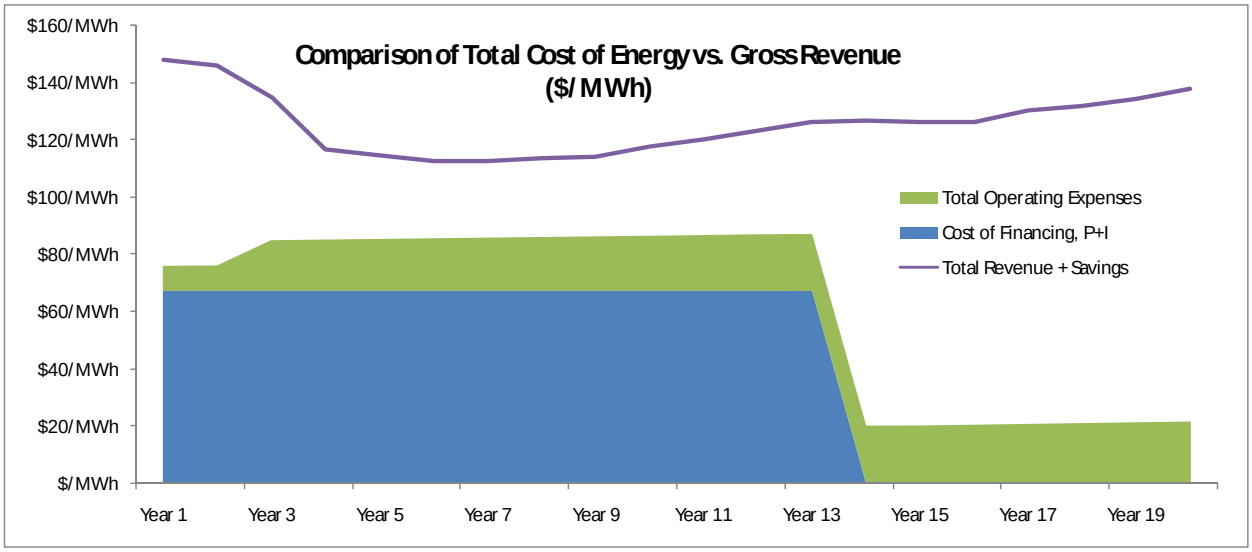

Figure 6 - 1.5 mW Middle School

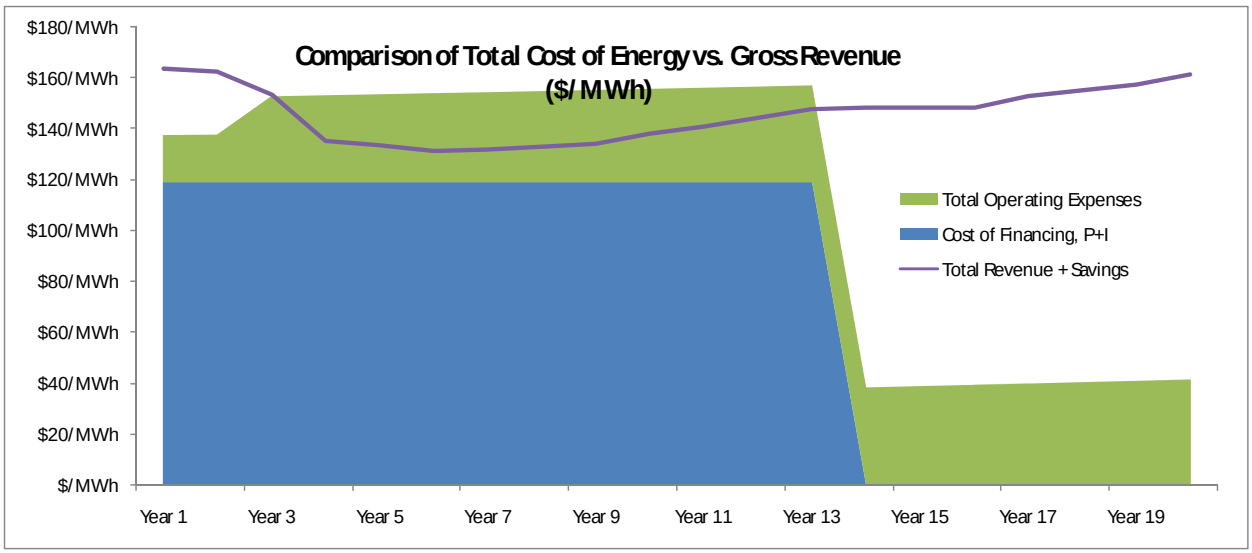

Figure 7 - 600 kW High School

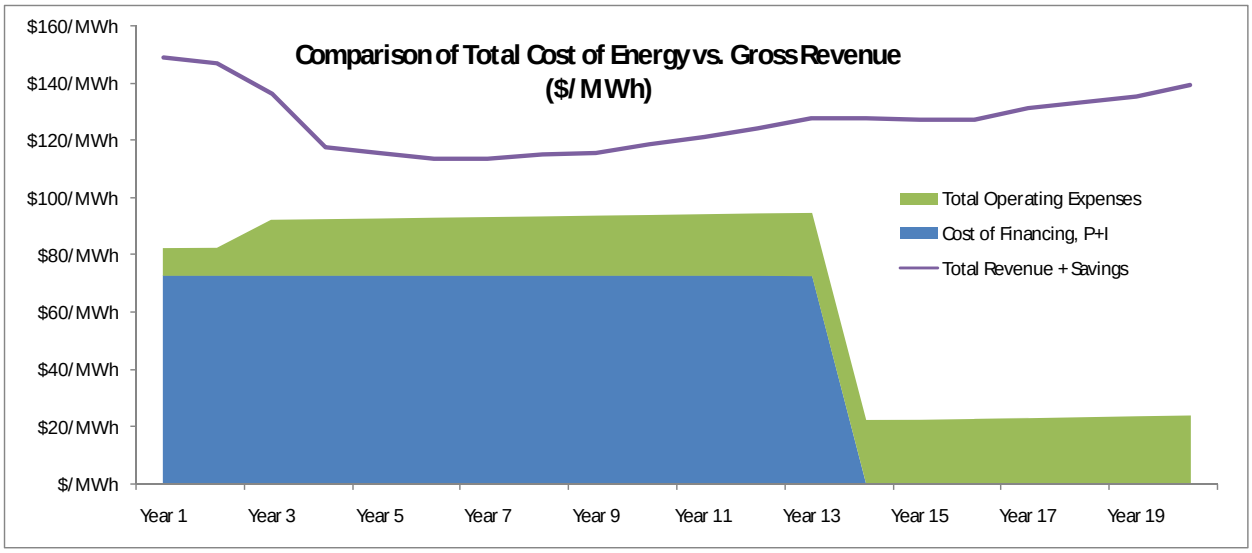

Figure 8 - 1.5 mW High School

Table 1 - Cost Comparison (p-50)

Case	Annual Cash Flow through life	Cumulative Cash Flow through life	NPV at year 20
FL 600 Middle School	Positive years 1-3 and 14-20,	Positive	$ 665,000
GE1.5 Middle School	Positive	Positive	$ 3,233,000
FL 600 High School	Positive years 1-3 and 14-20	Positive years 1-5 and 15-20	$ 440,000
GE 1.5 High School	Positive	Positive	$ 2,664,000

4. Other Financing Options. Several alternative methods of funding and operation were explored including third party developers that specialize in municipal size renewable energy development. One such company is Sustainable New Energy (SNE) located here in New England and the recent winner of a Fairhaven, MA RFP for a municipal wind power generation project. (See appendix E for related SNE information on the Fairhaven pro forma proposal). SNE like other developers assumes all the risks inherent in the development of a wind project requiring only that the municipality provide them with suitable town land (and a long-term lease) on which to install the wind generator(s). In return the developer will pay the town annual lease fees, property tax fees (for the generator itself) and will enter into a long term sales agreement to provide the town energy at the wholesale rate with some year over year inflation cost. For this risk the developer has the ability to sell energy at wholesale to the "grid" and the town, sell Renewable Energy Credits (REC's), use accelerated tax depreciation rules and claim production tax credits (PTC). Jim Sweeney, principal owner of SNE has provided our committee with a pro forma statement of expected revenues using the same wind data that ATM based their study on with a 1.5 mW machine at both the High School and the Middle School. While other firms may have different numbers as a result of their projections 3rd party development is a potential positive economic option should the Town wish to pursue same

5. Other potential economic model enhancements. With the laws and regulations in constant flux, one basic concept will always enhance the economic model. That is, using as much excess capacity "behind the electric meter" as possible to avoid having to send power back onto the electric grid. The subcommittee explored other potential initiatives that could be used to further enhance the economic return to use excess power during light load periods (e.g., at night, on weekends, and during the summer vacation period.) Some examples include:

- Supplying the power to the water pumping station across Union Street from the Middle School. There are several problems associated with this alternative. If power was supplied to the pumping station it would be from the power grid and not from the "behind the meter" Middle School power systems. If a power line was run to the pumping station to "behind the meter" of the Middle School, this would be an additional expense and would have to cross a utility right of way, which would require a specific agreement with the power company.
- Timed electric heaters to offset the demand from the non-electrical heating system at the school during evening hours.

The conversion of some of the Town's vehicle fleet to electric. Vehicles could be charged at the school at night.

The PEDC recommends that the Town continue to pursue innovative ways to best use the turbine's output power.

I. Liability, Indemnification and Capital Equipment Assurance

1. Liability and Indemnification. Since the turbine(s) would be operated on Town-owned property, any liability and indemnification issues would be covered under existing Town statutes. The Portsmouth Municipal Trust sees no exclusions (other than selling back electricity) which would limit or eliminate primary coverage and confirms that there are no unforeseen problems with liability or indemnification coverage. During construction, these issues would be as specified in the construction contract.

2. Capital Equipment Assurance. This covers two issues: Manufacturer and contractor warrantee. Any equipment failure issues would be covered under a manufacturer's warranty (usually 24 months). After the warranty period, equipment damage (other than those directly related to the manufacturer or construction contractor) would be covered under a separate insurance policy. Any issues related to construction would be covered under the contractor's warranty.

3. Operational Assurance. Continued operation after the warranty period will be covered under a continuing maintenance agreement with the manufacturer. Most turbines have sophisticated systems that continuously monitor all the critical operating parameters of the turbine. These parameters are automatically reported by the turbine to a central manufacturer's monitoring facility. The turbine reports data periodically and immediately if any parameter indicated a potential problem. The turbine's computer will automatically shut down the turbine to minimize the potential for damage and the manufacturer will dispatch a maintenance team to resolve the problem. A continuing maintenance agreement is included in the project cost estimates.

4. Physical surveillance. Routine physical monitoring and external surveillance of the turbine and turbine site will be the responsibility of the Town and can be done concurrently with other monitoring of the school property. The turbine tower has a lockable access to the internals that house turbine controls and a ladder to the nacelle. The external tower cannot be climbed.

5. Liability and Assurance Costs. The costs associated with liability and assurance related to capital equipment (i.e., the cost of separate private insurance for the turbine and the premium manufacturer's continuing maintenance plan) have been included as part of the economic analysis.

J. Community Issues

1. Public Information

a. Workshop with the Town Council. A workshop was conducted with Town Council. The Governor's Commissioner for the Officer of Energy Resources

provided a detailed brief on the State's posture, policies and plans for renewable energy resources. A copy of the presentation from that workshop is available at the Portsmouth Sustainable Energy Web Site (www.portsmouthRIenergy.com).

b. Public Forums. Three public forums were conducted in June 2007 to gather public concerns and answer questions. The sessions provided for an informal period where attendees could visit informational stations on Economics, Wind Resources, Siting and Facilities and Health and Environment where they could glean related information and ask questions. Then, a formal presentation was made with a question and answer period following.

c. Print Media (Newspapers). In order to ensure the media was actively involved, a number of press releases were issued to local print media (including the Newport Daily News, Sakonnet Times, Providence Journal and Providence Business News). As a result, the media actively sought information from us, attended our public information workshops and published several well-balanced and informative articles concerning our project.

d. Visual Media (Commercial Broadcast, Cable Community Services). The study team capitalized on the local cable TV media.

- A video of the June Public Workshop was aired on Cox Cable Channel 18 for Newport County at least 10 times during July.

- A Community Information posting is currently on Cox Cable Channel 17 for Newport County announcing a potential referendum on wind energy and directing viewers to the www.portsmouthRIenergy.com web site for information.

- A special "Newport County Forum" session is planned for just prior to the referendum ballot to ensure voters are well informed.

e. Sustainable Energy Web Site. www.portsmouthRIenergy.com was taken live in April 2007 to provide information on all sustainable energy issues. Initial emphasis was place on wind energy information. It provides information on the Town's wind energy plan, downloadable copies of documents, links to renewable energy web sites and answer to frequently asked questions. By naming the site as an "energy" site, we will continue to use it to not only track our pursuit of wind power, but also include other sustainable energy areas.

2. Public Opinion. Public opinion was gathered via our public information forums (see above), and questions submitted to a special e-mail address (questions@portsmouthRIenergy.com) and a written survey summarized below.

a. A total of 917 surveys were sent in stamped, return addressed envelopes.

b. Respondents were in four groups.

- Random Sampling - A random sample of 500 voters were chosen using the Town Registrar's list of registered voters. 500 residents were chosen.

- Middle School Abutters - A one mile circle was drawn around the Middle School. 212 residents within that circle were sent a survey.

- High School Abutters - a one mile circle was drawn around the High School. 205 residents within that circle were sent a survey.

- Voluntary Submissions - Copies of the surveys were placed at selected locations around town (e.g. Clement's Market, Library, Town Hall). Also, a copy of the survey was posted on the PortsmouthRIenergy.com web site for people to download and mail in. (58 were received)

c. Return rate and statistical confidence.

Respondents

358 total respondents were received in the following breakdown:

- 58 voluntary
- 137 responded to the random mailing for a return rate of 27%
- 72 responded from the High School mailing for a return rate of 35%
- 91 responded from the Middle School mailing for a return rate of 43%

Return Rate percentage was 37%. (35% High School Vicinity, 43% Middle School vicinity, 27% Random).

Statistical Confidence. The overall number of respondents provides for a Confidence Level (CL) 95% and a Confidence Interval (CI) of +/- 5% for the population of Portsmouth voters. (Middle School Vicinity CL- 95%, CI +/- 7.5% and High School Vicinity CL - 95%, CI +/- 9%)

Table 2 - Public Opinion Survey Summary

Total Mailed	Total Mailed	Total Responded	Percent Responded	Confidence Level	Confidence Interval
Middle School	212	91	43%	95%	+/- 7.5%
High School	205	72	35%	95%	+/- 9%
Random	500	137	27%	90%	+/- 5%
Voluntary	Na	58	100%	na	na
Total Respondents	917	358	37%	95%	+/- 5%

d. Summary of Results

(1) Of those people who had seen a wind turbine up close:

- 50% said the turbine sound was pleasant or very pleasant (low was 40% (Middle School vicinity), high was 57% (Random).
- 6% said the turbine sound was unpleasant or very unpleasant. (low was 6% (Random), high was 14% (Middle School vicinity))

(2) Of all respondents:

- 53% said the turbine was beautiful or very beautiful (low 48% (Random), high 64% (Voluntary).
- 12% said the turbine was ugly or very ugly (low was 3% (voluntary), high 6% (Middle School and High School Vicinity).
- 91% said that Wind Power was a good or very good investment for the Town. Less that 2% said that Wind Power was bad or very bad investment for the Town.
- 64% said they were very informed or informed about wind power, 7% said they were very uninformed.
- 90% said they would vote “yes” on a referendum to build a wind turbine using zero interest bonds. (93% random, 90% high, 88% middle school vicinity, 86% voluntary) (See Figure 9)
- 83% said they would vote “yes” on a referendum to build a wind turbine using bonds at market rate interest. (89% voluntary, 88% random, 78% middle school vicinity, 76% high school vicinity) (See Figure 10)

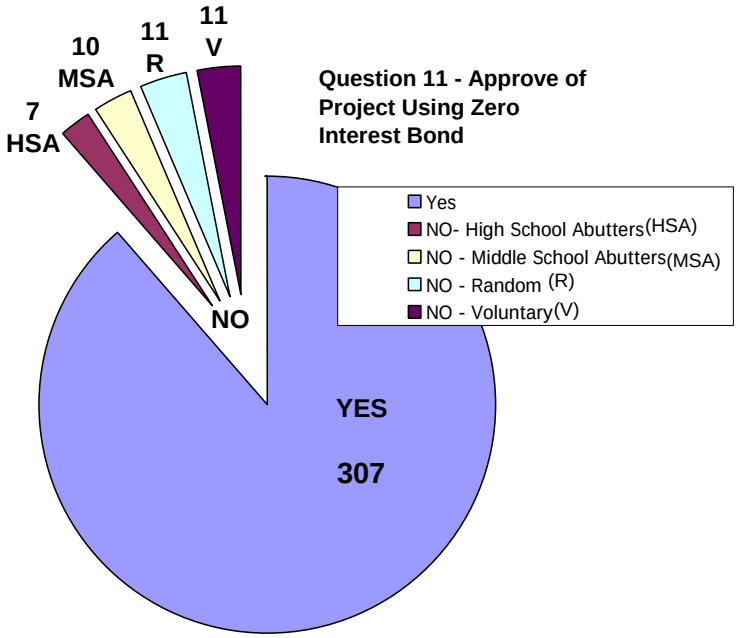

Figure 9 - Project Funding Approval - Zero Interest Bonds

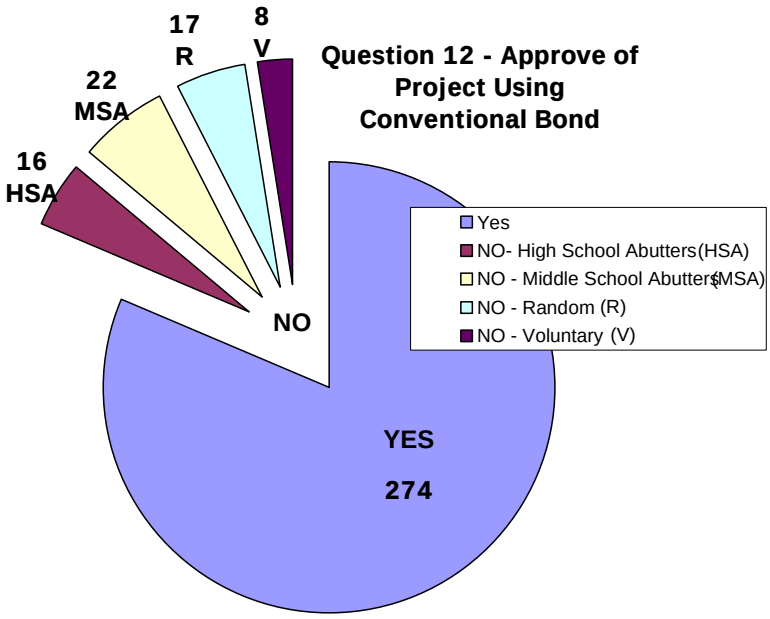

Figure 10 - Project Funding Approval - Conventional Bonds

A complete summary of the survey results and raw data is provided in Appendix D.

K. Referendum.

The Sub-committee contemplated that the Town Council would like to have the option to do a public referendum. Because of the lead time involved, the Town Council approved (January 2007) that a referendum be drafted that would provide a vehicle to gauge citizen support of the project.

The State legislature enacted a law on June 27, 3007 (H5217 and S0260) (Reference G) to allow the Town to conduct a voter referendum to borrow up to $3 million to construct a wind turbine at either the High School, the Middle School or both schools. The Town Council has authorized the referendum to be placed on the November 6th ballot. The legislation has exempted the borrowing from the 3% cap on aggregated indebtedness under RIGL 45-12-2.

It should be noted that the Town Council has the authority to unilaterally decide to borrow the money to buy the wind turbines without the need for voter approval or special legislation. However, the borrowing would not be exempted from the 3% cap on aggregated indebtedness under Rhode Island General Law 45-12-2.

L. Schedule.

Based on the best information available on the availability of wind turbines and the construction required, the following schedule dates are expected. (See a detailed schedule in Appendix F.)

· Town Council Approval
· November 6, 2007 - Town-Wide Referendum (if needed) or Town Council Approval
· November 12, 2007 - Release Request for Proposals for Turbine Purchase and construction
· December 27, 2007 - Select Turbine Contractor
· December 31, 2007 - Obligate CREB Funding
· October 2008 - Commence Turbine Operation

M. Conclusions

1. Physical Siting

a. The turbine installation proposed meets physical and electrical construction requirements.

b. The location of the turbine provides optimum locations considering wind resource and proximity to the school and abutting properties. Some residences (on the opposite side of the Middle School) fall within the 1000 foot proposed zoning circle.

2. Community Issues

Based upon our public workshops and surveys of individuals in the community there is overwhelming positive support for the project. There is a very small amount of negative support. Most people feel well informed on the wind project.

3. Environment and Health

There are no health hazards or risks associated with the turbine project above those associated with the current electrical supply systems at the schools. The wind turbine will not adversely affect the environment.

4. Permitting

a. The turbine will conform to existing zoning regulations, except that a variance will be required for the turbine height.

b. Authorization from the FAA has been submitted for the Middle School site. The request is pending.

5. Wind Resources and Economics

a. Positive Economic Return - Based upon a worst-expected case analysis, there is sufficient wind at the project site to support generation of wind turbine power with a positive economic net present value over the lifetime of every case postulated. Compelling evidence for the Middle School Site. The economic analysis associated with the construction of a 1.5 mW turbine at the Middle School is the clear best investment case that will return over $2.5 million to the Town over its expected life.

b. Further Potential Economic Enhancements. The following potential scenarios will further enhance the positive return on investment:
Any increase in electricity cost above the conservative predictions used in the analysis.
Legislation that improves the rate of return on power supplied to the electrical grid.
Any years beyond the minimum expected 20-year life the turbine is in operation.
Any enhancements the Town makes to increase power consumption behind the electric meter during times of excess generation capacity.

N. Recommendation: The PEDC recommends that the Town conduct the referendum authorized by State law and approve construction of a 1.5 mW wind turbine at the Middle School.

A workshop with the Town Council was held on October 1, 2007 that focused on the "next steps" beyond the voter referendum based on the two possible results: voter approval or voter rejection. While we are confident that the voters will agree with our recommendations we will endeavor to present clear options for both cases. At that workshop, the Town Council unanimously resolved to support the PEDC's recommendation.