

Orleans Renewable Energy / Wind Power Committee



Final Report to the Board of Selectman

June 17th, 2009

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1 EXECUTIVE SUMMARY

This final report of the Renewable Energy Wind Power Committee, as presented herein, is the culmination of the efforts by the Committee over the past 18 months. The Board of Selectman established the Committee in October of 2007. We are pleased to report that over 18 months we have accomplished a great deal of work. The Committee's charge, detailed in section 2.3 and 2.4 was to work on projects and concepts concerning renewable energy and wind power on behalf of the Town of Orleans. The attached final report contains four key areas with recommendations for the Board of Selectman. They are Wind Energy, Solar Energy, Regional Opportunities, and our Energy Future. The recommended actions were all supported unanimously by Committee votes. Supporting information leading up to these recommendations is detailed in the body of this report.

1.1 WIND ENERGY

The Committee studied options for Wind Energy throughout the Town. It looked at all past work efforts on wind energy and examined new and future opportunities. The body of the Committee work on wind is detailed in section 3 of this report and supports the following key recommendations.

- The Committee recommends that a single turbine be installed on the site known as Site 1, in the Orleans Watershed.
- The Committee recommends that a 600KW class or similar turbine be installed on the recommended site, Site 1, in the Orleans watershed.
- The Committee recommends that the project be referred to the Orleans Board of Water Commissioners for their approval.
- The Committee recommends this turbine be a Water Department project with the benefits of the project directed back to the Water Department.
- The Committee recommends that the Town move this project forward for development and that the BOS authorize the additional work necessary to develop this project. Once approved and supported, staff should move this project forward in the most efficient manner.
- The Committee recommends that the Board of Selectman support this project at an alternate site in Town, where feasible, if the Board of Water Commissioners do not accept this recommended project.
- The Committee recommends that if any of the variables that led the Committee to this recommendation change, such as electrical rates, net metering legislation, and regional ownership opportunities (CVEC), the Board of Selectman should re-visit this recommendation and modify, if necessary, so that this action is in the best interest of the Town.

1.2 SOLAR ENERGY

The Committee studied solar photovoltaic panels and arrays to see if any Town buildings could benefit from such an installation. In the past, two petition articles were brought to Town meeting for arrays on municipal buildings and they failed. The specifics of the petitions helped the Committee further analyze the overall performance of solar arrays and the financing requirements of a solar array on top of a public building. The Committee work on solar is detailed in section 4 of this report. The key recommendations are as follows:

- The Committee recommends monitoring the Department of Energy Resources (DOER) process that will provide “regulations” for the legislation that is the Green Communities Act (GCA). Every opportunity should be explored to net meter power at the highest possible rate for a Town solar installation.
- The Committee recommends seeking the best rates and 20 year borrowing for any municipal solar project considered.
- The Committee recommends that the Council on Aging building be considered a candidate for a solar photovoltaic array on its rooftop.
- The Committee recommends an array size of less than 15,000 Watts.
- The Committee recommends, if possible, installing a net metering facility independent of the COA building in order to distribute the power to other municipal accounts at the highest kWh value.
- The Committee recommends following the evaluation of buildings and verification measures outlined in this report. All of the financial parameters should be confirmed when the final GCA regulations are published.
- The Committee recommends that solar arrays be considered as part of new municipal construction or major remodeling in the future.

1.3 CAPE AND VINEYARD ELECTRIC COOPERATIVE (CVEC)

Shortly after the formation of the Committee, the County formed a new entity called the Cape and Vineyard Electric Cooperative (CVEC). The CVEC provides an opportunity to join a growing regional body that will develop renewable energy projects for member Towns and ultimately work towards returning low cost energy from those projects back to its membership. At May 2009 Annual Town Meeting, Orleans voted to authorize the Board of Selectman to review and potentially join this organization. A detailed discussion of the CVEC, its formation, goals, benefits, and membership rights and obligations are discussed in section 5 of this report. The Committee has one recommendation concerning the CVEC and it is listed below.

- The Committee recommends that the Board of Selectmen proceed with all actions necessary (including consultation with Town legal counsel), complete the application process, and finally, join the Cape & Vineyard Electric Cooperative

1.4 ORLEANS’ ENERGY FUTURE

The arena of renewable energy is developing and interesting opportunities continue to arise. The Green Communities Act is new and regulations governing this important legislation will be developed shortly. Orleans should continue to work towards energy independence and the Committee feels strongly that the Town should have an active group to monitor and advance renewable energy projects and initiatives. Therefore, the Committee recommends the following actions.

- Orleans shall continue to have a Committee dedicated towards the topic of renewable energy.
- The existing Committee be extended for an additional three months (September 20, 2009) or until a permanent Committee can be established, whichever is sooner.
- The new Committee should be established with a broad scope of duties (detailed in section 6).

2 INTRODUCTION

2.1 A NOTE FROM THE CHAIRMAN

As Chairman of the Committee I would like to take this opportunity to thank all of the Committee members, the liaison representatives, and all of the concerned citizens that contributed their time and energies to the efforts of this Committee. Without those contributions, this work could not have been accomplished. I believe that by adopting the recommendations detailed in this report Orleans can start down a path of energy conservation and independence.

2.2 COMMITTEE MEMBERSHIP

David L. Hubbard	Member
Victor S. Noerdlinger, Jr.	Member
Allen Kolchinsky	Chairman
Richard Philbrick	Member
Mary Jane Curran	Member
Robert McCoy	Member
Kenneth Rowell	Member
Liz Argo	Member (past member)

2.3 CHARGE TO THE RENEWABLE ENERGY WIND POWER COMMITTEE

The Board of Selectmen hereby establishes an ad-hoc committee to be known as the Renewable Energy/Wind Power Committee, hereinafter defined as the Committee.

The Committee shall be composed of five (5) individuals, appointed for a prescribed term of eighteen (18) months, who possess knowledge, experience and interest in renewable energy/wind power modalities and appropriate supportive technologies.

In addition, the Director of Planning and Community Development, or a qualified designee, shall be included as a non-voting member of the Committee.

The Committee is charged with the responsibility of working with the Board of Selectmen, Town Administrator, and Director of Planning and Community Development or designee, on the immediate investigation, research, development and establishment of operational procedures and guidelines for this project, including all aspects of revenue and cost analysis, in direct association and conformance with the operations requirements of the Town, under the oversight of the Town Administrator. These activities shall be in accordance with the Orleans Town Charter, town regulations, and the policies of the Board of Selectmen.

It shall be incumbent on the Committee to incorporate all relevant work to date, by previously existing committees, commissions, and other public and private contributing entities, concerning renewable energy/wind power efforts on behalf of the Town of Orleans.

The project shall require addressing and reviewing renewable energy/wind power options that meet the goals and objectives established by the Board of Selectmen and by the development efforts of prior committees. With this basis, the Committee shall explore and analyze a complete list as possible of all salient factors such as energy production, turbine size, regional opportunities, site locations, revenue expectations, business costs, turbine ownership, and a regional opportunity assessment review.

In developing a comprehensive Action Plan, the Committee shall recommend to, and work with, the Town Administrator and Board of Selectmen, in the engagement of such outside sources and consultants as it believes are necessary to support its project development mission.

The Committee's work product shall include, but is not limited to the following:

1. Work with town officials and other necessary agencies and resources in the investigation, research, evaluation and feasibility of locating, developing and utilizing renewable energy/wind power modalities for municipal and/or commercial use, with appropriate adjunctive technologies;
2. Identify real properties that may support the siting of renewable energy/wind power facilities;
3. Meet with local, state, regional and federal officials, and attend appropriate meetings and conferences that relate to alternative energy;
4. Prepare a complete action plan from concept to implementation, with guidelines that identify comprehensive cost/benefit analysis options which provide gross and net revenue and cost projections for this project;
5. Develop, maintain, and distribute a project schedule which shall compare predicted progress check points against actual project status. The schedule shall include next step and upside and downside development comments.
6. Provide quarterly reports to the Board of Selectmen and Town Administrator on Committee activities and project status assessment.

The Committee is expected to complete its charge within eighteen months of its first meeting.

2.4 COMMITTEE APPROACH

Below is detail on each one of the specific charge details and what the Committee accomplished to bring some closure to the task.

1. The Committee worked closely with the Planning Office throughout its 18 month charge. The Committee also met with, from time to time, the Water Superintendent, the Board of Water Commissioners, and the Board of Selectman.

Other agencies/persons were also approached on specific topics. The Committee met with state officials to discuss the exit 12 land for wind energy. The Committee met with MTC officials at a wind seminar to discuss grant opportunities and learn about the new Commonwealth Wind program. The Committee met with county officials to review the membership opportunity for the newly formed Cape and Vineyard Electric Cooperative. Finally, the Committee met with Massachusetts Maritime officials, including Admiral Richard Gurnan, and toured the MMA wind turbine.

2. The Committee worked with the Planning Office and the Orleans Zoning Bylaw to identify properties for wind development. An evaluation of these sites is included in this final report. A map of these sites is included in the appendix of this report.
3. The Committee attended meetings of the Cape Cod Energy Committees Group on a regular basis. At these forums information was shared from other Towns Energy Committees. Most notably meetings on Town projects, progress, and issues regarding energy in Cape town's were discussed. Many times this forum was used by regional officials to present regional opportunities to Town Committees.
4. The Committee has developed plans of action for both wind and solar photovoltaic energy in Orleans. This final report includes a specific section on each of these renewable energy technologies and a recommended action for both.
5. A project schedule has been included in the report on advancing a wind energy project in the Orleans Watershed on Site 1. No project schedule was developed for a solar project but a specific recommendation has been provided.
6. Throughout the Committee's term quarterly reports were provided to the Board of Selectman. They proved helpful in guiding Committee research and provided necessary approvals for spending on outside help.

2.5 GREEN COMMUNITIES ACT

Shortly after beginning work on the Committee charge a significant piece of State energy legislation was passed. The Green Communities Act was signed into law by the Governor on July 2, 2008. The Act has many incentives for renewable energy projects. The Act also has guidelines for becoming a "green community" and dedicated funds to help municipalities advance in this program. Perhaps the most notable provision is the act allows for "net metering" of electricity from municipal land based wind facilities up to 2 MW. This provision allows electricity to be sold at retail rates (\$0.15) instead of wholesale rates (\$0.05), thereby increasing revenues for municipal wind projects. This is a significant provision and increases the benefits for renewable energy development.

Throughout this report sections make reference to the Green Communities Act and its provisions. While the legislation has been passed, the regulations governing the legislation have not been promulgated or passed. The Department of Energy Resources (DOER) is due to work on these regulations this summer and, once passed, the specifics should be understood by the Town of Orleans. Many of the recommendations are based on allowances within the Green Communities Act and it is assumed that the regulations would not unduly limit any of these allowances (such as net metering). This legislation provides unique opportunities for renewable energy development. A complete copy of the act is listed at the following site:

<http://www.mass.gov/legis/laws/seslaw08/sl080169.htm>

3 WIND ENERGY

3.1 WIND ENERGY SITE IDENTIFICATION

As stated in the charge to the Renewable Energy Wind Committee the Committee shall “Identify real properties that may support the siting of renewable energy/wind power facilities”. For this task the Committee used the Town GIS to identify all parcels that met the basic requirements of the Orleans Zoning Bylaw as it relates to Commercial Wind Facilities. The basic requirements are:

- Parcels with a minimum lot size of 5 acres.
- Parcels with 5 or more acres of which 4 or more acres classified as buildable upland.
- Land in public or state ownership. *Note: Private lands were also identified initially but not studied any further.*
- From this initial screening the Committee decided to take a closer look at 6 sites. They are as follows:

3.1.1 EXIT 12 CLOVERLEAF NORTH

This site includes the area inside of the northerly most Exit 12 on/off ramp to Rt 6. The site is approximately 7.6 acres in size and is all buildable upland. The topography of the site is sloping and the site slopes downward from north to south. The elevation at the approximate center of the site is 38’.

3.1.2 EXIT 12 CLOVERLEAF SOUTH

This site includes the area inside of the southerly most Exit 12 on/off ramp to Rt 6. The site is approximately 8.5 acres in size and consists entirely of buildable upland. The topography of the site is sloping and in general the site slopes upward from the surrounding roads to a hill approximately in the center of the site. The elevation at the approximate center of the site is 96’.

3.1.3 TONN PROPERTY

This site includes a number of Town owned lots located along Giddiah Hill Road. This site includes the 7 lots owned by the Town that collectively make up 6.82 acres that currently serve the Orleans Highway Department maintenance facility and the drainage infrastructure for the adjacent capped Orleans Landfill. The topography of the site has been severely altered as part of the landfill capping work. The elevation of the site is estimated at 54’. This area was chosen because it was clear of all drainage infrastructure and existing buildings on the site.

3.1.4 TRI TOWN PLANT

This site includes land owned by the Town of Orleans but under the management of both the Tri Town Board of Directors and the Town of Orleans. The Committee identified the lot south of the existing compost shed for this analysis. The site consists of 6.23 acres and is adjacent to both the existing Tri Town Seepage facility and Route 6. The topography of the site is sloping and it rises to a hill in the approximate center that has an elevation of 76’. The Committee recognizes that there are a number of competing municipal interests for the property. The Committee also recognized that there is significant power demand on site today with the potential to increase, therefore, the site was considered for analysis.

3.1.5 ORLEANS WATERSHED

The Town of Orleans Watershed is a 500 acre parcel located in South Orleans with access off of Rt 28. The Watershed parcel has been studied for wind energy and was found a suitable location for up to 6 commercial grade wind turbines. Within the watershed parcel, one site "Site 1" has undergone major investment by the Town and by the Massachusetts Technology Collaborative. Because of this investment and available information such as a wind feasibility study, avian study, and Nstar interconnection study; the Committee feels site 1 is perhaps the most desirable site for wind in the Town of Orleans. The elevation of the site is approximately 80' and after 18 months of meteorological study, the site was found to have a viable commercial wind resource. Although a previous wind project failed to move forward in the watershed the site still is of significant interest and merits renewed consideration.

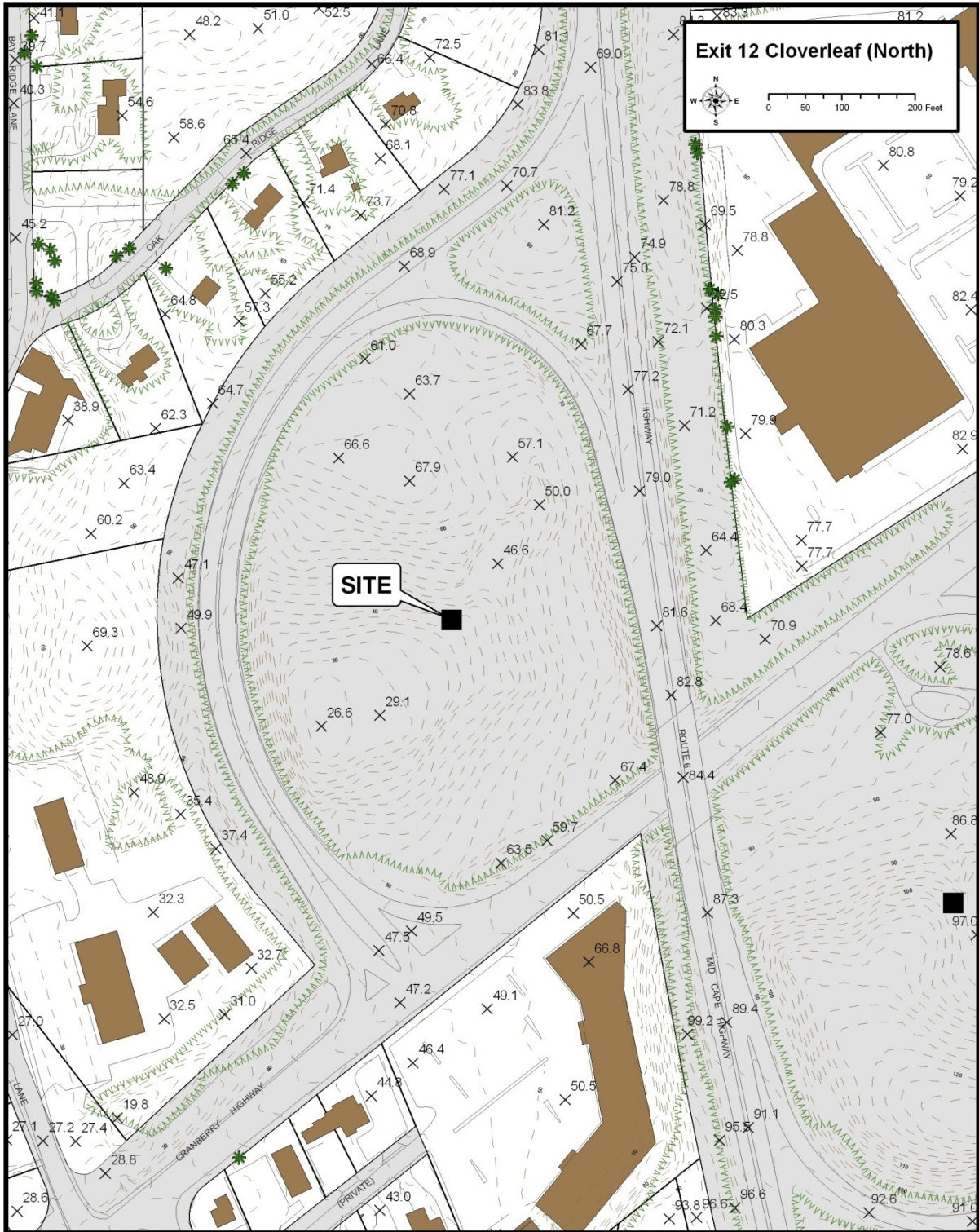
3.1.6 ORLEANS LANDFILL SITE

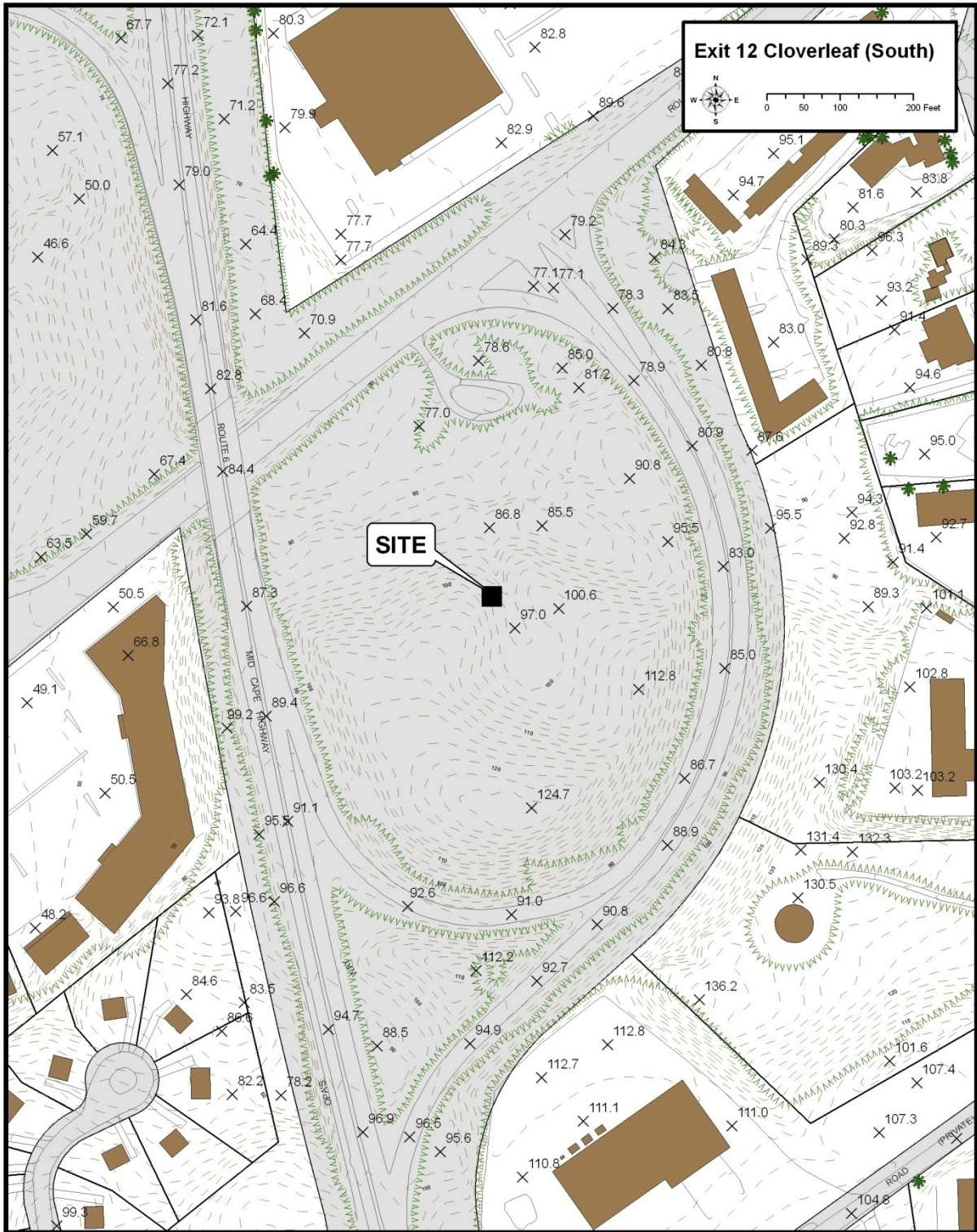
This site is part of the parcel that is the site of the Town of Orleans Landfill and Transfer Station. The site consists of 19.2 acres in size and the majority of the site is a capped municipal solid waste (MSW). The Committee did identify an area of interest that is located outside of the capped MSW and wanted to analyze it further. This site is located in the southerly most corner of the parcel itself and as noted above, is outside of the MSW cap. The elevation of the site is 111' and is only accessible via access over Giddiah Hill Road and the adjacent Orleans Watershed parcel.

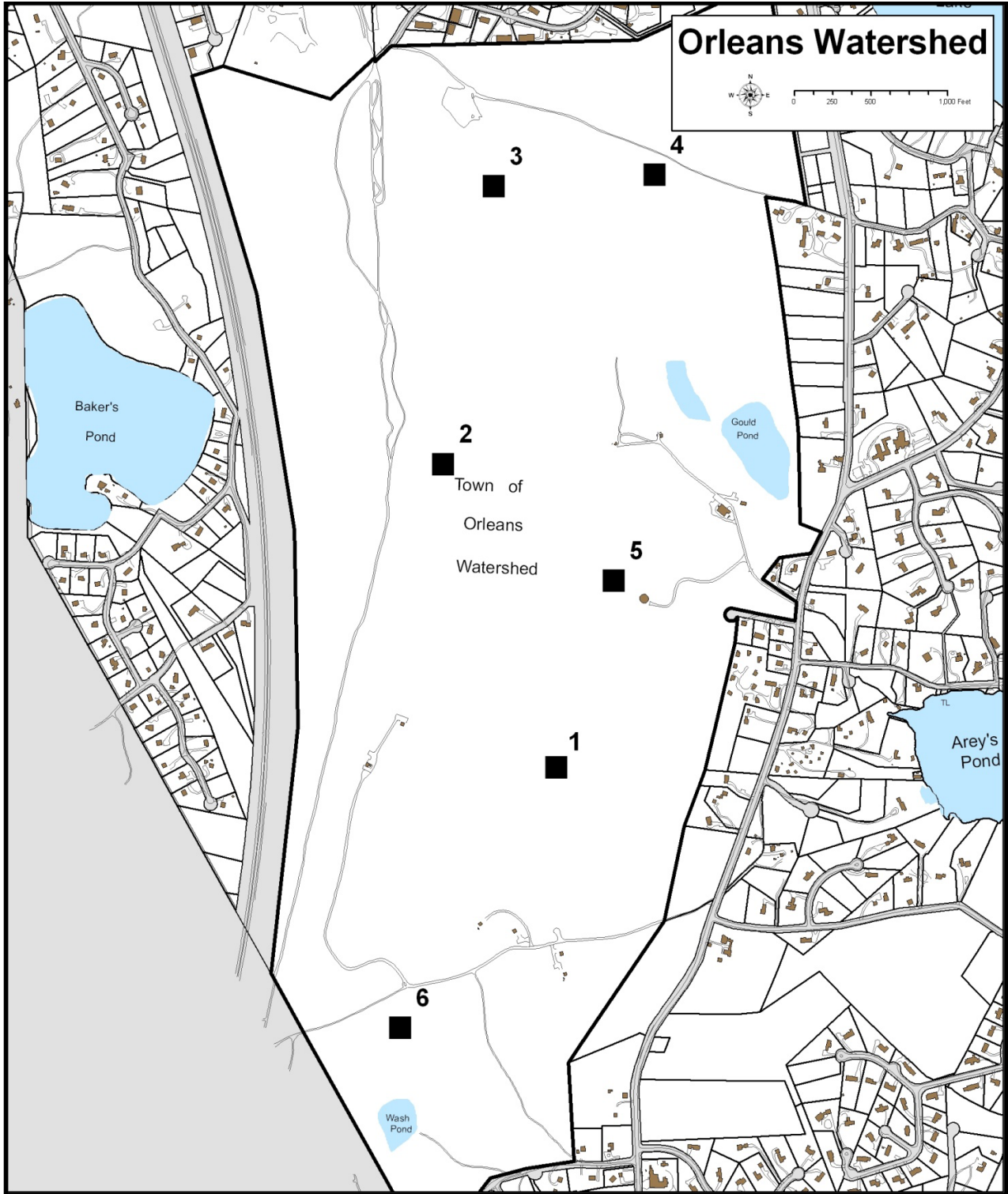
3.1.7 ORLEANS ELEMENTARY

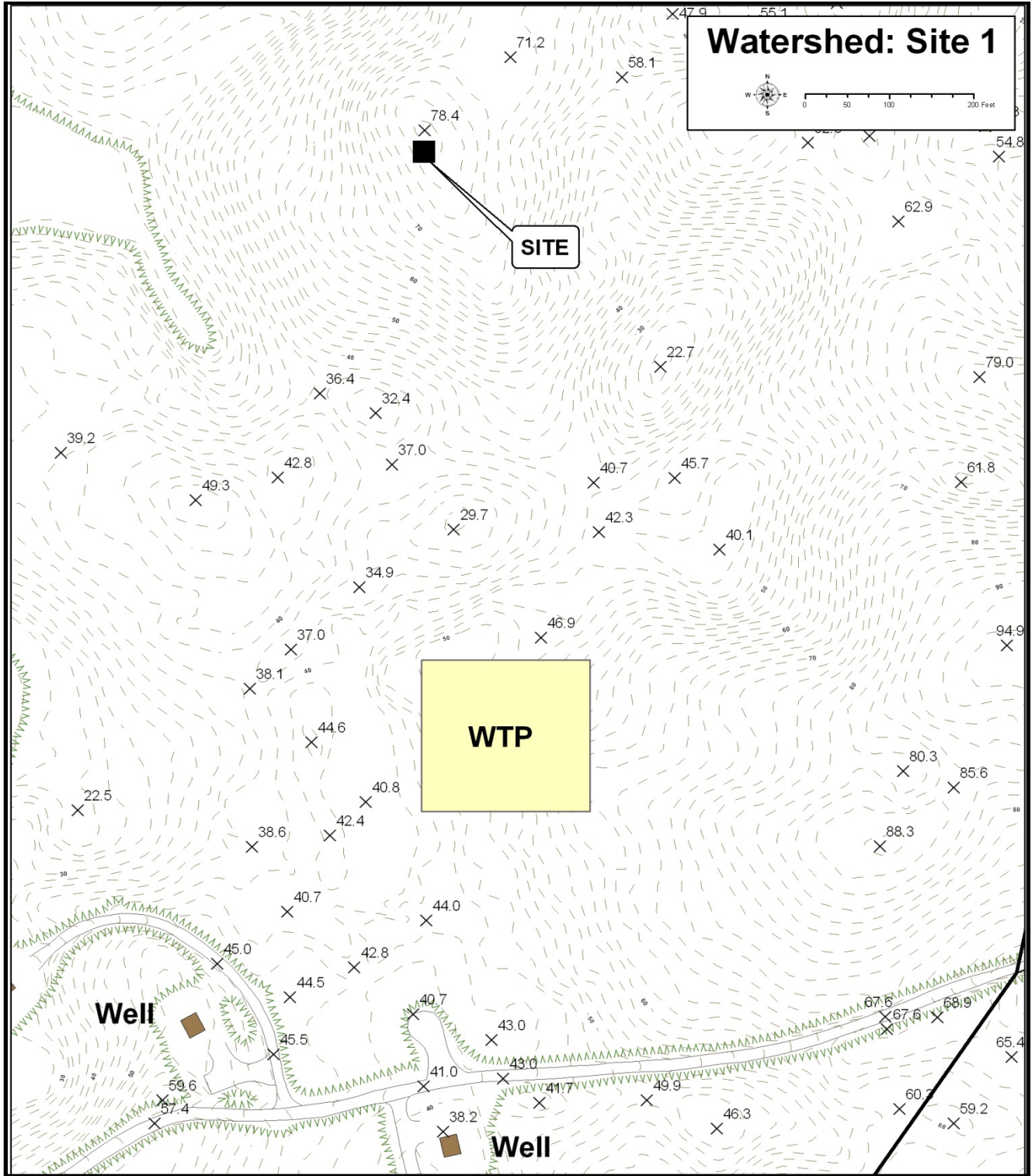
This site is located in the rear of the parcel that is home to Orleans Elementary school and the Orleans Fire Department. Specifically the Committee looked at the area to the rear of the parcel that is wooded and currently abuts the ball fields which is also located in the rear of the parcel. The topography of the lot is level and the elevation of the site in the rear of the lot is 51'.

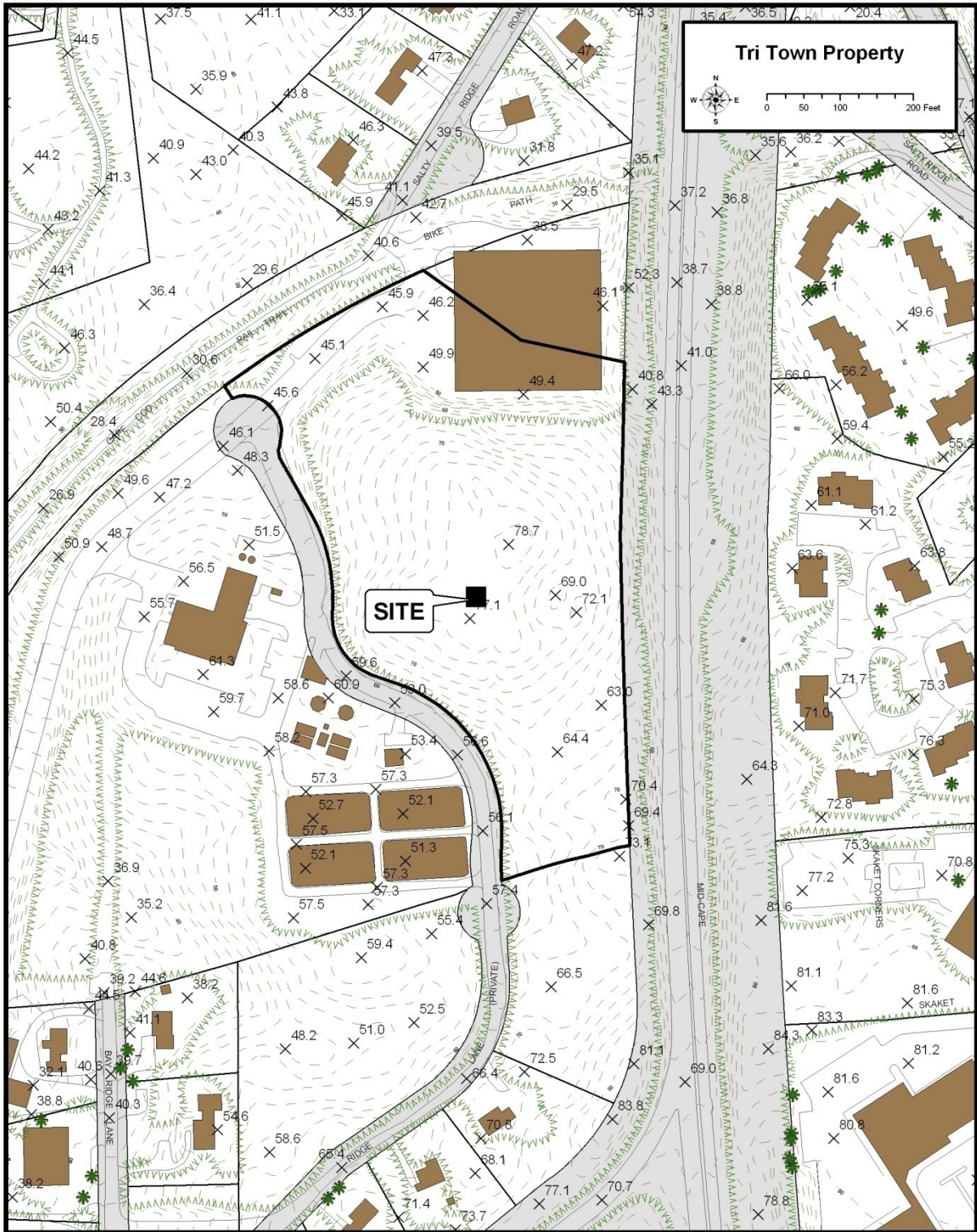
3.2 WIND ENERGY SITE MAPS

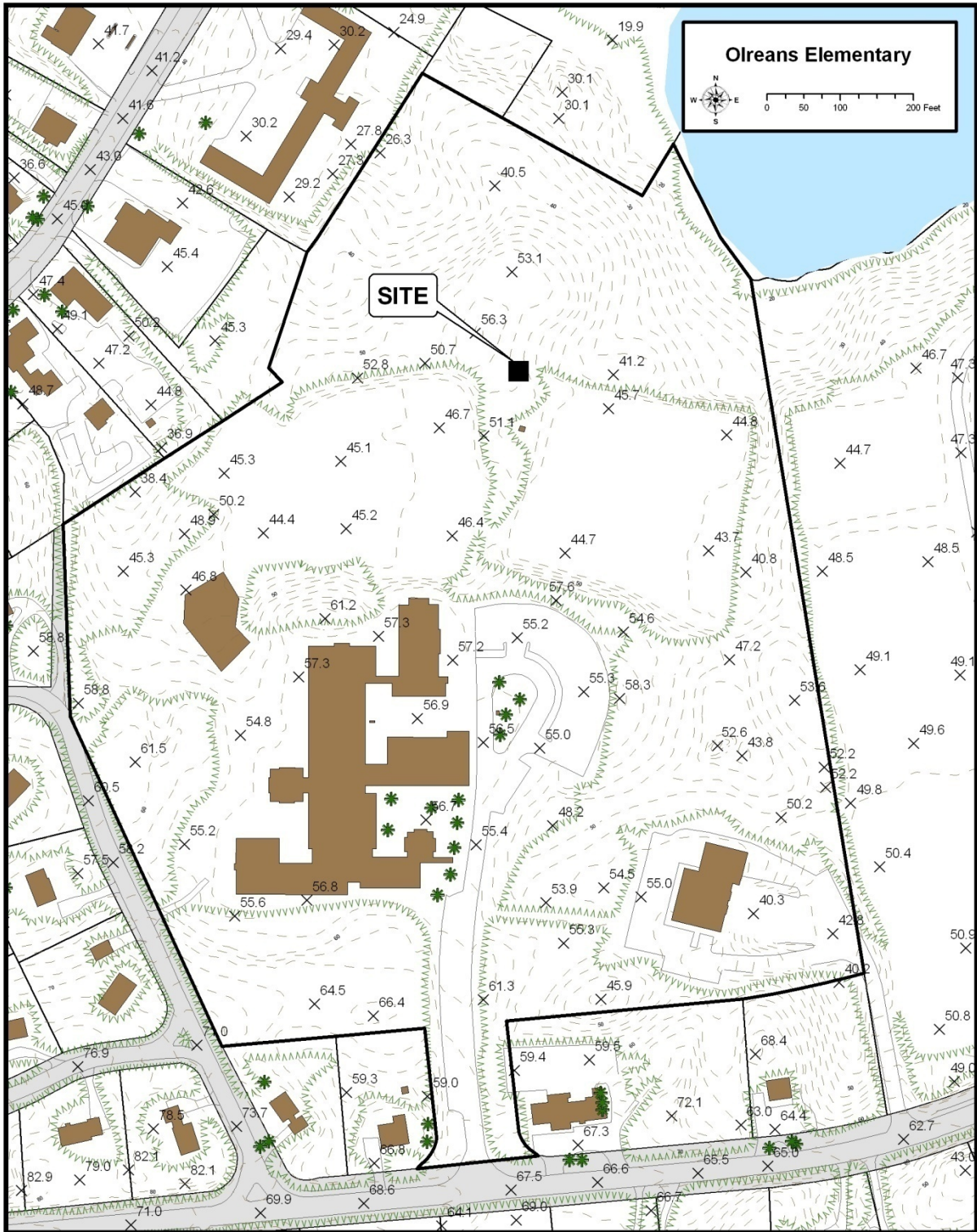












3.3 WIND ENERGY SITE ANALYSIS

3.3.1 REGULATORY PROCESS

With a list of sites identified, the first thing to understand is the regulatory process that all sites would be subject to for installation of a wind facility. The approval process is a long one and most of the sites required a similar approval track beginning with Board of Selectman endorsement of a concept and proceeding all the way to the final step of obtaining a Special Permit from the Zoning Board of Appeals. Some sites required more stops along the way for various approvals. The Orleans Watershed is by far the easiest site to permit due to the significant amount of work that is already complete for Site 1 within the Watershed. The TONN property ranked the second easiest site to permit largely due to its Town ownership and control. The Landfill site and Tri Town site prove the most difficult due to the fact that they are DEP and Orleans Board of Health controlled sites. Table 3.1 below lays out the approval and regulatory process for all 7 sites. The totals on the right hand side compile the total number of regulator steps in each sites process. Where a “?” is listed it was not clear whether that regulatory stop would be needed or not.

Table 3.1: Wind Site Regulatory Process

SITE	Meetings and Approval Process														# Permitting stops in the Regulatory Process						
	BOS Endorsement of Concept	School Endorsement of Concept	MTC Municipal Site Survey	State/MHD/ Federal Highway Approval	NSTAR Impact Study	Town Meeting Approval of Wind Project	Development of Regulatory Documents	Site Plan Review	Board of Water Commissioners	Tri Town Board of Managers	BOS Approval of Final Plan	School Committee Approval of Final Plan	Article 97 Approval (Watershed Land)	Environmental notification Form (ENF)		NSTAR Interconnection Permitting	Environmental Impact Report (EIR)	Board of Health (Site Assignment Site)	DEP (Site Assignment Site)	Cape Cod Commission Review	Zoning Board of Appeals
Exit 12 Cloverleaf (North)													?			?			?		12
Exit 12 Cloverleaf (South)													?			?			?		12
Tonn Property																?			?		10
Tri Town Plant													?			?			?		13
Orleans Watershed						?										?					6
Orleans Landfill Site													?			?			?		13
Orleans Elementary																?			?		12

Note: If cell is shaded then an approval is needed. If shaded with a “?” then an approval MAY be needed.

3.3.2 SITE EVALUATION

In order to further understand the sites and their potential to support commercial wind facilities, the Committee leaned heavily on work completed by the previous Wind Committee and the Massachusetts Technology Collaborative (MTC). In reviewing the MTC feasibility study for a wind turbine in the Orleans Watershed, the Committee wanted to test similar facility requirements on the newly identified sites. Specifically, maximum tip height (MTH), and the required setback distance as specified in the Orleans Zoning Bylaw (MTH+100’). For this

analysis the Committee chose to test the same two facility types that were tested as part of the original MTC feasibility types. They are the Vestas 660kw turbine and the General Electric 1.5MW turbine.

Table 3.2: Turbine Heights

Turbine	Maximum Tip Height	Required Setback
Vestas 660kw	274'	374'
GE 1.5MW	389'	489'

Source: MTC Feasibility study

Also of interest and importance is the area required for clearing for both facilities. Past site work related to wind projects had shown that in order to stage and set up such facilities a clear area is required. For the purposes of this analysis the required clear areas were estimated to be as follows:

Table 3.3: Turbine Space Needs

Turbine	Required Clear Area
Vestas 660kw	200' x 150'
GE 1.5MW	250' x 300'

Source: MTC Feasibility study

Finally, as part of this analysis the Committee wanted to test the required noise buffer of 600' as stated in the Orleans Zoning Bylaw. The Bylaw provides 2 methods of meeting the noise standard for commercial wind facilities, one of which is to provide 600' of distance from the turbine to the nearest property line. The other is to meet the required 60dbA at the nearest property line. Table 3.4 displays a matrix of how each site performed for some of the required setbacks discussed. Listed in the table is a "yes" or "no" if that site was able to meet the requirement. The Orleans Watershed sites were the only sites to meet all of the required setbacks.

Table 3.4: Turbine Evaluation / Zoning Requirements

		Site Evaluation - Zoning Requirements							
		Meets Setback for 660 kw (374')	Fall Zone for 660kw CLEAR (274')	Meets Setback for 1.5 MW (489')	Fall Zone for 1.5 MW CLEAR (389')	Meets 600' Noise Setback Alternative	"Clear Area" available for 660 kw	"Clear Area" available for 1.5 MW	Existing Meter (Load) on site
SITE									
SITE	Exit 12 Cloverleaf (North)	Yes	No	No	No	No	Yes	Yes	No
	Exit 12 Cloverleaf (South)	Yes	Yes	No	No	No	Yes	Yes	No
	Tonn Property	No	No	No	No	No	Yes	Yes	Yes
	Tri Town Plant	No	No	No	No	No	Yes	No	Yes
	Orleans Watershed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Orleans Landfill Site	No	Yes	No	Yes	No	Yes	Yes	Yes
	Orleans Elementary	No	No	No	No	No	No	No	Yes

3.3.3 SITE EVALUATION FINDINGS

In summary, none of the sites, except the watershed sites, met the required setback from property lines for the GE 1.5MW turbine. In addition, none of the sites, except the watershed sites, were able to meet the 600’ noise buffer to the nearest property lines. All of the sites outside the watershed would have to satisfy the noise requirement in the bylaw by providing proof that the decibel reading threshold would not be exceeded. With regards to the setbacks and area required for a 660 kw facility some of the sites had some potential to support this type of wind turbine.

Because of some effects that large setback and noise requirements had on the sites identified, the Committee did look into smaller wind facilities as well. Specifically, the committee examined the Northwind 100kw machine that has become popular in the Northeast. The Committee reviewed its physical requirements, financial data, and payback models. This technology is being used in Hyannis at the Country Gardens. The Northwind turbine is manufactured in Vermont and is an efficient and interesting option for a small wind generator. Although not considered by the Committee as commercial scale wind or a facility that is able to offset a large part of our municipal load, the Northwind 100kw may have some merit at specific locations.

Table 3.5 represents the general suitability listing of all of the sites examined by the committee. The Site ID is a unique number that corresponds with the wind site map included in the appendix.

Table 3.5: Wind Site Map ID's

SITE_ID	SITE	EVALUATION
1	Watershed Site	Commercial Wind
2	Watershed Site	Commercial Wind
3	Watershed Site	Commercial Wind
4	Watershed Site	Commercial Wind
5	Watershed Site	Commercial Wind
6	Watershed Site	Commercial Wind
6B	Watershed Site	Commercial Wind
20	Landfill	Commercial Wind
21	TONN	Take No Action
22	Exit 12 South	Commercial Wind
23	Exit 12 North	Commercial Wind
24	Tri-Town	Needs Further Evaluation
25	Orleans Elementary	Small Wind
26	Courthouse	Small Wind

Note

Viable for Commercial Wind is intended for a 600KW or greater facility

Viable for Small Wind is intended for a 100KW or similar facility

3.3.3.1 Exit 12 Cloverleaf North

The topography and natural elevation of the site are not as desirable as some of the others. The site is basically in a hollow with poor elevation in the center. However, it did meet the required setback for the 660kw facility but the fall zone was not completely clear and included part of the ramp (see map). Access to the site does not exist and is something that would have to be constructed. It is likely that a substantial amount of clearing and fill would be required to locate a wind turbine in the center of the site. No municipal meter is located on site but the site is adjacent to the Tri-town septage treatment property which is directly on the other side of the ramp. This site used in coordination with the Cloverleaf South site has excellent possibilities to link municipal properties across Rt 6A while providing land area for potential future municipal use.

3.3.3.2 Exit 12 Cloverleaf South

One of the more significant findings of this committee work was the potential of the exit 12 cloverleaf site. This site met the setback requirements for the 660kw turbine, had a clear fall zone, and also has great elevation. The site had available area for the required clearing, it also has good existing access off of RT 6A and could be easily fenced or controlled due to its location inside of the ramp system. The site did not meet the noise setback requirement but the Committee feels strongly that decibel requirements could be met at property lines. There is no municipal meter currently located on the site so interconnection and distribution of any wind produced power are things for future consideration. Nearby municipal meters include the Orleans Landfill and the Tri Town facility. This site used in coordination with the Cloverleaf north site would provide a link to the Tri Town Septage facility

meter. Also abutting Town land provides access to the NSTAR high tension wires and a possible connection over public lands.

3.3.3.3 Tonn Property

In order to meet the area requirements for the overall site the multiple Town lots would have to be combined. Even in doing so, the site would not meet the required setbacks for either wind turbine facility. The elevation of the site is also less desirable than some of the others and the Committee recognizes that there are competing municipal interests on the site presently and possibly more to come in the future. The site does provide a somewhat shorter regulatory path as it is municipally owned and operated. In addition, there are municipal meters on site both at the maintenance facility and at the Transfer Station itself.

3.3.3.4 Tri Town Plant

The Committee recognizes up front that the Tri Town site has been part of ongoing wastewater management discussions as well as discussion for a future Town DPW facility. The Tri Town site does not meet the setback requirements for either facility and is limited in space despite its overall parcel size. The site is also controlled by the DEP and the regional board of directors, which makes permitting and approvals difficult. However, the site has good elevation and is home to one of the larger power users in the community, the Tri-Town septage plant. The Committee may need to look further into a smaller facility or different technology on this site.

3.3.3.5 Orleans Watershed Sites

The Orleans Watershed is by far the most suitable site for commercial wind in Orleans. The 500 acre parcel allows for multiple sites to meet all the zoning requirements for commercial wind. In the initial feasibility study both the 660kw and the 1.5MW turbine were sited, meeting all zoning requirements, on multiple sites. The Committee recognizes there is merit in looking at all of these sites in further detail but the Committee focused its efforts on Site 1 due to available information and previous work completed.

Site 1 has the benefit of major investment in wind energy planning and study. A feasibility study was completed in 2004 after 18 months of meteorological testing. Following that, both an avian study and an NSTAR interconnection study were also completed for this site. All of this work offers a major savings in the project development stage of any future new project. The Committee feels this site is the most suitable for wind energy development.

3.3.3.6 Orleans Landfill Site

This site has the best elevation of all of the sites we looked at. If it were not for the rear lot line of the landfill parcel that divides the landfill lot and the Orleans watershed lot this site would meet setbacks for both wind turbine facilities. However, the line exists and therefore the site does not meet the setback requirements. The Committee feels relief from this requirement, due to its uniqueness, may be an option. This site does provide clear fall zones for both the 660 kw and the 1.5 MW turbine. In discussions at Committee meetings, it was envisioned that access to the site, which is outside the capped municipal solid waste would be via Giddiah Hill Road over Town watershed property. Therefore this site would require approval from the Board of Water Commissioners for access and to supply the clearing area even though the facility is proposed to be located on the landfill lot. Also due to the capping, the site is also controlled by the DEP and Orleans Board of Health which makes its permitting track complex. There is a municipal meter located on site at the Orleans Landfill.

3.3.3.7 Orleans Elementary

This site did not meet the required setbacks for either of the wind turbine facilities. The site is level with below average elevation. The site does have significant municipal loads on site in both the school and the fire station. The required clearing for staging and setup could be done in one of the existing ball fields instead of clearing new land to do so. This was a technique that was used by the developer who installed the 660kw at the Massachusetts Maritime Academy. The fall zone for this site would have athletic fields within it, and may warrant further discussion and study.

3.4 WIND ENERGY FINANCIALS

3.4.1 MUNICIPAL OWNERSHIP MODEL

The Committee, with the consent of the Board of Selectman and the Board of Water Commissioners hired the firm of Weston and Sampson to complete a financial feasibility study of a municipally owned and operated wind turbine in the Orleans watershed. The intent of the work was to understand the effects of the Green Communities Act and net metering on a single turbine installation owned and operated by the Town.

For the purposes of this study the Town advised the consultant to analyze a 1 megawatt class turbine or similar. This was mandated because the entire output of a 1 MW turbine could be to offset by the existing Town electrical load, without producing excess, which is currently over 1.5 million kilowatt hours. The Committee felt being able to net meter 100% of the power output would be important to any successful economic approach. However, the Committee does recognize that the municipal load will likely grow in the future with the Water and Sewer operations under consideration.

The report presented a comprehensive review of the critical factors and considerations analyzed as part of the economic feasibility study for installing a single commercial scale wind turbine at the site. The feasibility study incorporated data from prior reports as well as information in the new Green Communities Act. It also conducted a review of the electricity usage and rates, estimates of construction, operation and maintenance costs, evaluation of the market value of wind-generated electricity, including the assessment of Renewable Energy Certificate credits associated with development of a single commercial-scale wind turbine in the Town watershed property.

The economic analysis estimated the cost to design, permit and construct a single 600 kW wind turbine would be approximately \$2,300,000. The Net Present Value of a single 600 kW wind turbine is estimated to be \$859,000 using a discount rate of 4% over 20 years. Average net annual cash flows of \$70,000 were estimated from a 600 kW wind turbine, with a net cash flow of \$1,400,000 over 20-years. Based on a one year construction schedule, during which time no energy was produced and debt service was due, the report showed that the project would have a positive cash flow by the fifth year of operation. The benefit to cost ratio of the project would be 1.31, which is considered economically attractive and the study recommended the Town move forward with this project and this site for wind energy development.

The consultant identified a number of factors that could influence the economic performance of such a project. They include the actual wind speeds, reduced costs from potential grant funding, changes in energy rates and final net metering rules, which have yet to be promulgated. The consultant also noted that the preliminary economic projections are also very sensitive to initial capital costs, which are subject to market fluctuations.

Table 3.6 below includes some summary information about the consultants recommended wind facility on Site 1 in the Orleans watershed.

Table 3.6: Economic Results Summary

Turbine Size	Elecon 600 KW
Project Cost	\$2,320,500
Cost per KW	\$3,868
Annual Energy Output	1,338,703 KWH
Net Present Value of Project	\$859,468
Net Cash Flow (20 yrs)	\$1,439,320
Benefit Cost Ratio	1.31

Source: Weston and Sampson Report

3.4.2 CAPE AND VINEYARD ELECTRIC COOPERATIVE (CVEC)

The Committee spent a great deal of time working on gaining an understanding the Cape and Vineyard Electric Cooperative (CVEC) and its membership, operation, and benefits. It should be stated that the Committee ultimately supports membership in the CVEC. Also a more detailed description of the CVEC is available in section 5 of this report. Limited progress was made on understanding the financials of a CVEC owned and operated wind turbine in Orleans due to the fact that the CVEC is not yet able to produce the necessary financial details. However the Committee does understand the basic offerings that accompany a CVEC project but until one is developed and the details become public there is little to confirm at this point.

Unlike the municipal ownership model the CVEC project would not be developed by the Town, funded by the Town, nor would it be maintained by the Town. In the CVEC model, the CVEC secures a lease area, from the municipality, in which to develop a wind energy project. For this lease area, a lease payment is paid to the Town. The CVEC also secures its own loan for the project cost and does not need to go to the town meeting to authorize borrowing for the project. Loans to the CVEC are made available at low interest rates (0%-2%), possibly lower than can be secured by the Town. Based on the CVEC model, 10% of the power generated by the faculty is used by the Cape Light Compact to stabilize the rates of it members. As to the 90% of electricity produced it is sold back to the Town at the best rate possible for a 15 or 20 year period that is negotiated as part of the CVEC lease agreement with the host community. In initial discussions with the CVEC, it is clear that the best possible deal is turned back to the community. The CVEC needs to keep and maintain enough revenues to cover annual debt service, administrative costs, and operation and maintenance contracts. The Committee feels that the specifics are not known but the financial offer to the Town is assumed to be similar to the municipal ownership model financials.

3.4.3 MUNICIPAL VS COOPERATIVE OWNERSHIP

The following table contains summary information of the two ownership models. Based on our current level of information on Cooperative financial benefits, many details are left as “negotiated”. Without detailed financial data provided from the CVEC, the committee could not make a complete comparison.

Table 3.7: A Comparison of Ownership Models

Comparing Ownership Model Cost and Benefits		
	TOWN	CVEC
Cost to Town	\$ 2,320,500	None
REC Revenue	\$46,000 average annual	None(Goes to CVEC)
Lease Payment	None	Negotiated
Power to Net Meter	100% of production	90% of production
Cost of Power to Town	39% annual average savings*	Negotiated fixed price for 20 years
Control	Local	Regional
Risk	Local	Regional
Borrowing - shows on tax bill	No	No
Borrowing - Town meeting approval	Yes	No
Loan Term	20 Years	20 Years
Loan Rate	0%-2% or Market 4.5%**	0%-2%**
Net Project benefit	\$ 2,113,431	Based on above negotiations
* Weston and Sampson report		
** 0 to 2% interest is available on Clean Renewable Energy Bonds (CREBS)- a share of all CREBS are help for Cooperatives and the rest are available on a competitive basis- 4.5% is assumed to be the municipal bond rate.		

3.5 WIND ENERGY RECOMMENDED ACTION

After looking at all of the original wind sites and additional wind sites throughout the Town, The Committee recommends that a single turbine be installed on the site known as Site 1, in the Orleans Watershed.

After looking at the facility types proposed in the original two turbine project, and touring the watershed and meeting with staff from the Water Department, the Committee recommends that a 600KW class or similar turbine be installed on the recommended site, Site 1, in the Orleans watershed.

After reviewing the published report by the engineering firm of Weston and Sampson, the Committee understands that a municipally owned and operated 600kw turbine is a viable project on Site 1. The Committee recommends that the Town move this project forward for development.

After requesting a detailed financial pro forma for a Cape and Vineyard Electric Cooperative (CVEC) owned and operated turbine in the Orleans watershed and receiving none, the Committee realizes it will conclude its charge without this important information. It is, however, still the Committee’s recommendation to become a member of the CVEC in order to participate in Cape-wide renewable energy initiatives and gain better insights into the potential advantages of cooperative ownership for future Orleans projects.

The Committee also recommends that if any of the variables that led the Committee to this conclusion change, such as electrical rates, net metering legislation, and regional ownership opportunities (CVEC), that the Board of Selectman should re-visit this recommendation and modify, if necessary, so that it is in the best interest of the Town.

The Committee recommends that the BOS authorize the additional work necessary to develop this project. Funding for this feasibility work can be achieved through the available balance (\$18,533) of the original 2003 article for the feasibility of wind in the watershed. This additional study should include specifications on access, a purchase strategy along with accounting recommendations, a shipment and transport plan of the turbine to the site, and details on the cost of the assembly and the necessary electrical connections. This effort would be used to

prepare documents for local, regional and state approvals of the project. The goal of the further study is to obtain the necessary documents that will lead the Town to a turn- key purchase, installation and operation of a turbine. Specifically, the following should be looked at more by a Town Board, staff or outside expert to provide some answers:

Access to Site 1

The Committee recommends that a new site plan be prepared so that it can be used for local approval of the project. As a part of the site review, the site should also be reviewed to determine if changes are required to the electrical infrastructure that currently provides electricity to the treatment plant. Such changes might be needed due to the installation of a wind turbine-generator. If changes are required, they should be identified. Costs for these changes as well as possible impacts on the terrain and costs due to additional or larger power lines should also be provided. Possible Nstar requirements should also be identified and evaluated.

Financing Strategy

The Committee recommends an investigation of how best to fund the initial 5 years of the project. Zero interest construction loans, free cash, and reserve accounts should all be examined to determine the best way for the Town to finance the project.

Under the Green Communities Act provisions are detailed for the establishment of an enterprise fund. As the project creates revenue via avoided electrical costs, the Town would like a detailed strategy on how to manage electrical accounts that are used to create revenue for the project through virtual net metering. The strategy should include which Town electrical accounts to use and show how the net benefits will be redistributed.

Assessment of Risks

The Committee recommends that an assessment be made to estimate the costs/risks to the town in the event of two worst-case equipment failures. Although early failure is not expected, the Committee would like a better understanding of some of the costs associated with a worst-case scenario. The first scenario would involve description of costs to the town of an “in-warranty failure” such as a gear box failure that would necessitate the lowering of the nacelle to ground level for repair. The second scenario would involve description of costs if the same event occurs “out-of-warranty”. Availability and cost of insurance to cover such failures should be included in the analysis. This work would also include the financial impact due to the out of service time during a failure.

Operation, Maintenance, and Management

The Committee recommends an identification and evaluation of possible operation and maintenance plans together with an evaluation of these plans. At a minimum these should include credible Town directed options as well as the turn key purchase of operational and maintenance service from qualified suppliers.

Finally, because the facility is located in the Orleans Watershed and under the jurisdiction of the Board of Water Commissioners, the Committee recommends that the project be referred to the Orleans Board of Water Commissioners. In doing so we anticipate they would have the support of the Board of Selectman in following up with the additional work needed and moving the project forward as an Orleans Water Department capital plan item to be submitted in FY10. In the event that the Board of Water Commissioners do not accept this

recommended project, the Committee recommends that the Board of Selectman support this project at an alternate site in Town where feasible.

3.5.1 ACTION TIMELINE

The Committee felt strongly that the municipal model is a viable model and that the following timeline should be advanced. If the Water Commissioners and Board of Selectman approve the project concept then town staff should move this project forward in the most efficient manner.

Table 3.8: Timeline to follow for Municipal Project Development

BOS forward Wind Turbine to BOWC for project development	Summer 2009
BOWC undertake project and additional work with outside help and staff	Summer / Fall 2009
Submit as Capital Plan Item for Water Department	November 2009
Support project at Capital Plan public Hearing:	February 2010
Support Town Meeting vote affirming Capital Plan	May 2010
Submit as Warrant Article (Funding Authorization/TM Vote):	February 2011.
Support Town Meeting Vote:	May 2011
Funding available for project	July 1 2011 (FY 2012)
Turbine up and running	July 2012

Note: The Committee recognizes the only way to move up this process is to go right to a Town meeting vote (3/4 required) in May 2010 for borrowing authorization.

4 SOLAR PHOTOVOLTAICS

The placement of solar voltaic panels on the roofs of buildings and in other locations is now a well-established practice. One of the tasks of the Renewable Energy and Wind Power (REWP) Committee was to identify real properties that may support the siting of renewable energy facilities (in this case, solar photovoltaic panels on rooftops of Town-owned buildings).

4.1 EVALUATION OF BUILDING SITES

First, the Town owned buildings were identified and then each building was evaluated for its suitability for a solar PV installation. The COA building was selected as a prime site for evaluation. The criteria for solar installations and the industry methods to evaluate these criteria were already available as established practice. The criteria evaluated are as follows:

- Roof orientation, shading and permanence.
- Roof pitch.
- Roof shingles.
- Roof loading and power system installation
- Roof Area, composition and permanence.
- Selection of the solar power system.

4.2 ROOF ORIENTATION

In its early stages the REWPC made a search for a prime candidate building for a roof installation to provide a PV solar power system for such a building. Table 4.1 provides an evaluation of the buildings not considered prime and the reasons for that conclusion. It should be noted that the Orleans Elementary School already has a two-kilowatt solar installation, mounted on a flat roof with a tilted structural array of solar panels. The Cape Light Compact provided the two-kilowatt solar system to the school via their Educational Outreach Program. The power output records for this installation may be accessed on the Internet. The site is as follows:

<http://view2.fatspaniel.net/FST/Portal/KWmanagement/orleans/HostedAdminView.html?&eid=33854> Also available are other live sites for fat spaniel, the data gatherer of the arrays at: <http://www.fatspaniel.com/live-sites/index.html>

In choosing candidate site for further evaluation, the committee considered the following:

- A proposal was made, by petition, to install a PV solar array on the Town Hall roof. That proposal was turned down by Town Meeting.
- The Police Station was under review, by committee for a tear down and rebuild. The police station is a strong candidate for incorporation of a solar array. However, the police station renovations were turned down by Town Meeting in 2008.
- Both buildings ranked high based on our initial evaluation criteria.

Table 4.1 provides a summary of the committee's evaluations, with details as to why each was not selected as the preferred municipal building for a solar installation.

Table 4.1: Summary of Municipal Building Review

Building	Reason for less preferable rating
Nauset Beach Administration Building	Small Roof Area
Skaket Beach Facilities building	Small Roof Area
Orleans Community Center	Low Pitch and Abundant Shading
Orleans Fire Station	Small Roof Area
Orleans Legion Hall	Poor Roof Orientation
Orleans Elementary School	Low Pitch/ Rack Required-higher expense
Orleans Band Shell	Small Roof Area/Poor Orientation
Orleans Harbor Masters Office/Garage	Small Roof Area
Orleans Highway Department	Renovation or Demolition Potential
Orleans Parks Department	Renovation or Demolition Potential

The Council on Aging (COA) building was selected as the best candidate building for a solar PV installation by the Committee. A feasibility study was completed by Solar Wrights, a renewable energy company, for the COA building as part of a grassroots effort under the program Green Energy Towns (GET). This study was presented by the committee chairman to the Board of Selectman (BOS) in early 2008. The Selectmen took no further action on the feasibility study as it was a recommendation from a local grass roots organization and not solicited by the Town. This study with additions and modifications was used by the Committee as an illustrative example in this report. The COA building remains a prime candidate for a solar PV installation.

4.3 ROOF PITCH

Roof pitch increases in importance as the latitude increases. The tropics are suited to a flat or slightly pitched roof, as the sun is directly overhead at sometime during the year. As the latitude increases the importance of roof pitch increases. In eastern Massachusetts the most desirable pitch has been determined as 35 degrees by the National Renewable Energy Laboratory (NREL).

Table 4.2: Optimal Pitch for fixed solar installation arrays in Eastern MA

Pitch	Annual AC Energy (KW/H)	Incremental difference in KW/H annually from optimal pitch of 35⁰
40 ⁰	12,112	130
35 ⁰	12,242	Optimal
30 ⁰	12,180	62
25 ⁰	12,044	136
20 ⁰	11,833	211
15 ⁰	11,546	287
10 ⁰	11,183	363
5 ⁰	10,748	435
0 ⁰	10,236	512

Source:NREL

Scientists of the laboratory have developed a computer program (PVWATTS) that will calculate the amount of solar power generated at a particular location and with a panel tilt of different tilt angles as shown in Table 4.2. NREL is probably the most important authority in the country on solar energy. For those interested in details, the site may be accessed at: <http://www.nrel.gov>. NREL provides a basic calculator that will calculate the amount of solar energy and its value for any site in the country. To adjust parameters in this calculator, go to site http://www.nrel.gov/rredc/pvwatts/changing_parameters.html The information from this site is contained in the Appendix. Included in this appendix is information on the spacing required for the tilted panels.

The pitch of the southeast wing of the COA roof is 30 degrees. From the values provided in Table 4.2, the annual electrical production is calculated to be 99% of that at the recommended pitch. This minimal loss of energy production by itself precludes the necessity to evaluate the cost of including roof-mounted hardware to change the pitch of the arrays.

If there were to be a greater loss in power production due to variations in roof pitch, it would also be necessary to evaluate this modification and in particular the additional space needed between the rows of the south to north oriented panels. For tilted panels additional panel spacing is required to preclude shading of the northerly panels from the southerly panels. All of the panels for this case are pitched higher than provided by the roof pitch alone. The additional spacing will also require space that might be used to provide a larger array of panels. It would be necessary for the supplier to evaluate the tradeoff between better pitch and more panels at a less efficient pitch. Partially shaded panels should be avoided. The shaded panels have only the sunny portion of the panels producing electricity and the inactive shaded portion provides a path for internal current flow within the panel. Partial shading greatly deteriorates the power production of the panel and in severe cases might result in panel failure. Avoidance of shading should eliminate concern for this problem. The sun's rays are capable of penetrating snow, but the electrical output will be greatly reduced.

4.4 ROOF SHINGLES

Roof shingles are generally rated on the basis of years of life. This rating along with the year of installation and a roof inspection are used to evaluate the shingles on the roof. The main source of deterioration for an asphalt shingle roof and for many other roofing materials is exposure to the sun and the same PV rays used to provide the energy for the solar cells. Shingles that are protected from the sun (by solar panels) experience an extended life. Thus shingles that are judged as satisfactory should generally last for the life of the PV cells.

Another factor to consider is the degree of coverage of the roof by the PV panels. The greater the coverage the greater is the protection to the shingles. It is believed that if a small portion of the shingles are not shielded and deterioration should occur, that portion of the shingles may be replaced or repaired to enable the solar installation to fulfill its full life expectancy. This should be confirmed by a roofing expert for any site under consideration.

4.5 ROOF LOADING AND POWER SYSTEM INSTALLATION

All of the requirements of the Massachusetts Building Code must be met by the installation. The Building Code currently has requirements for roof loading and for capabilities to withstand wind speeds up to a speed of 110 miles per hour. The installation requires attachment to the roof. This is normally done by locating the roof rafters and drilling pilot holes through the shingles into the rafters for the use of lag bolts to hold the panel structures in place. A sealing agent is used within and around the holes. This may be supplemented with the use of flashing to deflect water runoff.

Any installation of solar panels would need to be submitted to the Building Department for approval with data from the manufacturer and installer with the necessary engineering analysis, if necessary, to insure that the building code is met. An interesting and informative description and video of an installation is currently available through the good offices of Green Energy Towns on their site or directly at:

<http://video.google.com/videoplay?docid=2346152759608825040>

4.6 ROOF AREA

The roof area determines the number of possible solar panels. The composition of the roof protective layer may influence the installation requirements. The permanence refers to the life of the building and the shingling. A roof that soon needs replacement shingles might delay the installation or speed the time of shingle replacement.

4.7 SELECTION OF THE POWER SYSTEM

For the COA building, the available area of the approximately 81 feet by 13 feet roof is 1,053 square feet. The panel area is approximately 3 feet by 4 feet or 12 square feet each. The roof can fit approximately 87 panels. To determine the final size of the installation, the panels must be matched to the standard inverter sizes and capabilities. Inverter cost is a significant cost of any solar array. It is very important to match the array size with a cost effective inverter. In this case the most economical match resulted in a selection of a 15-kilowatt inverter and a panel array supporting 14.76 kilowatts of electrical generation. The cost of a inverter of this size is \$10,184.

When a building is selected for a solar PV system, it is recommended that the MTC website be visited for guidance on how to proceed. A qualified roof inspector should be used and the original supplier of the roof should be consulted as well for his assessment and warranty guidance. The solar system supplier should be consulted on maintenance requirements for such things as weather effects of snow, leaves and other debris. In addition, advice and instructions should be obtained on detection and replacement of any failed panels or modules. It is understood that currently, the warranty on the panels is 20 years and the warranty on the inverter is 5 years. These should be detailed and confirmed at the time of purchase of any system.

4.8 BASICS OF PV SOLAR FINANCING FOR CAPE COD TOWNS

The Commonwealth of Massachusetts has enacted the Green Communities Act energy legislation encouraging the use of renewable power. One of the terms of the legislation institutes a timetable for increasing the proportional use of renewable power every year by the utilities. If the utility does not install its own renewable power, the utility must purchase Renewable Energy Certificates (RECs) from an entity that has installed such power or follow an authorized alternative method. So, long as the value of the RECs is less than the cost of installing the renewable power by the utility, there should be a market for RECs. RECs are normally issued to the entity that owns the PV generating facility.

The amount of energy delivered back to the power line may be used by the provider in a later billing period. Net metering is a system that allows energy produced by a renewable energy source to be credited to the producers account. When the power produced exceeds the requirements at the site, the excess power will run the energy meter backwards. This procedure reduces the energy supplied by the distributor. The result is an avoided cost for the town. This avoided cost and the sale of RECs provides a revenue stream to pay for the PV system.

In Massachusetts PV solar financing for towns is supported by rebates from the Massachusetts Technology Collaborative (MTC) to encourage the use of PV solar power. The rebate reduces the amount that the town pays

for the PV generating system. Since a sizable investment is involved in the purchase of such a system, the town will normally take out a loan to cover the net cost. Existing state law, Chapter 44, Section 7, Clause 3B, required payment of this loan in no more than 10 years. The law also requires equal annual principal payments together with the interest on the remaining value of the loan. This law was in force when the committee identified sites for solar and chose the COA site as the prime candidate.

On July 8, 2008 the Green Communities Act (GCA) was signed into law. The allowable payback period was extended from 10 years to 20 years. While the general concept of the act is understood, the regulations governing the provisions are still being established by the Massachusetts Department of Energy Resources (DOER). The implementation of the GCA has been delayed until DOER issues the regulations (expected mid 2009). The longer loan terms provide lower annual debt service and greater flexibility to PV financing options.

A town that installs a PV solar system has usually had out of pocket costs for the system during the initial years of operation. The savings have been expected in the latter time period of operation. This has been the usual situation for a town installing a solar system on the roof of a building. The use of larger solar systems than can be installed on a building roof is not covered in this financial analysis. It should be noted that the MTC encourages the concept of third party ownership of larger PV solar facilities. The Cape and Vineyard Electrical Cooperative (CVEC) will support third party ownership for member towns that have PV sites that are 40 KW and larger. The CVEC is a recently started renewable power producer. Cape and Island Towns are eligible for membership.

4.9 EVALUATION OF A PV SOLAR SITE

The MTC, in the past, had published a financial computer model available on their website for communities to analyze the costs/benefits of a solar PV installation. At the time this report was written, the model had been withdrawn and a new model corresponding to the Green Communities Act was being prepared. The former model accepted the estimates entered for the parameters used in the calculations. Since many parameters are not precise but are best estimates, that program provided an estimated result. That model dated (02/07/08) was used for the calculations in this report. The Appendix of this report contains the details of the analyses presented. These details include the input values for the parameters and the financial results by year.

After a loan is arranged by a town, it must be repaid. Payback funds for these loans are provided by a revenue stream consisting of the avoided electrical costs due to the production of electricity by the PV solar system plus the sale of RECs.

4.10 EVALUATION USING A TEN YEAR LOAN TERM

For the systems installed and proposed on the Cape using the 10 year payback period, the payment revenue stream has been less than required for annual loan payments. Thus an out of pocket cost has occurred for the town until the ten-year loan has been paid in full. The cumulative out of pocket cost either at the end of the loan or after replacement of the inverter is the cost to the town for the system, not the amount of the loan. For a system optimized around a 15 KW inverter and good site conditions such as for the COA building, this cost has been calculated at \$20,000. These numbers and those that follow apply to the analysis used to evaluate the COA proposal in Orleans.

A break-even point is reached when the revenue stream recovers the cumulative out of pocket cost. The break-even year for the system proposed for the COA site occurs in year 14 (see appendix: Solar Wrights/10 year loan).

The inverter used in the PV solar system is expected to last for at least 15 years, so provision is made in the MTC model to pay for an inverter at that time. The revenue stream and/or the town must pay this expense.

The break-even year occurs approximately halfway into the life of the system. In the first 14 years, the revenue produced has paid off the loan and the out of pocket cost. In years 14 through 30, or until the system needs replacement, the cost of the electricity is the cost for operation and maintenance. This cost will be low compared to the cost from the utility. It is estimated from the model to be less than 7% of the annual billing.

4.11 ADJUSTING FOR INFLATION

The MTC model uses an avoided cost revenue adjuster. Lower adjuster values provide for more conservative financial estimates. The forecast of future inflation is difficult, particularly for a time period over 30 years. This inflation forecast provides a major influence on the savings calculations. The use of accumulated cash flow as shown in the MTC model over the last half of the life of the installation is not a good measure of savings. With the annual adjuster, the dollars are not comparable to present day dollars.

Two consulting firms have used two different rates of inflation. Solar Wrights used a 5% annual inflation figure for the COA feasibility study. The wind consultant, Weston and Sampson, hired by the Town used a 2% inflation figure in estimating wind economics. The Committee, when testing the MTC model and the COA solar installation, generally used a 3% and 5% inflation figure.

With a 3% compounded annual adjuster, the inflated dollar is worth two thirds of the value of the present day dollar after 14 years of operation. With a 5 % annual compounded adjuster, that dollar is worth one half of the present day dollar in those 14 years. The dollars saved should be compared to the value of the present day dollar. Thus a Present Value (PV) should be calculated for analysis. PV is a financial analysis term. It has been used to evaluate investments made. In doing so a discount rate is used to bring future earnings to a present value. In the present case, the discount rate is the inflation rate. It is used to reduce the future inflated earning to present value.

Unlike the savings calculation, the full value of the avoided costs paid in future years can be used to offset the annual payment of the loan if electrical inflation is equal to or greater than inflation of the currency. To the extent that electricity costs escalate more than the inflation of the dollar, the value of the future saved dollar compared to today's dollar is only partially diminished.

To avoid the problems with inflated dollars, the payback may also be expressed in terms of the number of years of low cost electricity that is produced. It is also possible to calculate the savings in dollars valued at PV for this same time period. The town saves the charges from the utility for the energy no longer delivered. In addition, the value of the RECs for these years must also be evaluated. This evaluation can be done in terms of the PV dollars. In the current case, the savings occurs over the last 16 years of projected life. The present value of the savings may be calculated by adjusting the value of the cash flow for each year to present value. The total savings is then the sum of the savings for each year from the loan payment year to the year of the final nominal life of the system. The value is calculated to be \$50,057 as compared to the unadjusted \$153,000. The calculation is included in the Appendix.

4.12 REC MARKET

The nature of the REC market has been difficult to determine. This situation has made forecasting the value and term of RECs difficult for a solar installation. It does appear that for smaller quantities, a consolidator is needed to accumulate a sufficient quantity of RECS to market. Thus, the value and term appear to be harder to forecast for smaller quantities of RECs. It is recommended that the REC values, the loan term and the buyer be identified at the time of a system purchase.

4.13 IMPACT OF THE GREEN COMMUNITIES ACT ON SOLAR PV SYSTEMS

With the passage of the Green Communities Act, several new opportunities are available:

- The value of the nonprofit rebate has been increased.
- The time to pay back a loan has been increased to 20 years.
- The concept of virtual net metering has been introduced.

These are all significant and powerful changes.

4.14 LOAN PAYBACK TIME EXTENSION

The extension of the loan time is very significant. With an increase in the term of the loan, it is easier for the revenue stream (avoided electric cost and REC sales) to meet or exceed the annual loan payments. If this is accomplished, then there is no out of pocket cost and the solar system can be installed at no cost to the town.

As previously noted, the avoided costs of the energy generated in the years of loan payback plus the value of the RECs sold is used to pay for the loan. If the loan time is extended to 20 years utilizing the same model inputs as for the 10-year term, , the revenue stream nearly matches the required payment for the first year and exceeds the required payment for later years. The savings in PV dollars may be done as before, but now the savings should be over the entire life of the system. This results in a savings of \$52,497 as compared to the unadjusted \$140,209.

The 20 year loan period described provides a savings of \$52,497 based on a present day dollars with no out of pocket costs as compared to a savings of \$50,057 and an out of pocket cost of \$20,000 for the 10 year loan.

It should be noted that the MTC model does not provide for the removal and disposal of the solar panels at the conclusion of their useful life. In our analysis, no cost was carried for removal and disposal. These panels have chemical content and must follow proper disposal procedures. Provisions should be made for this disposal.

4.15 VIRTUAL NET METERING

The concept of virtual net metering appears most applicable to wind turbines and large PV solar projects where the output exceeds the needs of the closest site to the installation. With virtual net metering, the excess power may be used to offset the electrical usage at other town sites.

The sites chosen for solar projects should be those with the highest cost for energy distribution. It is important to note here and for other areas of this report that Town buildings pay \$.20 per KWH for the first 2,300KWH used. When an account uses more than 2300KWH per month the charge for the electricity goes down to \$.17. Therefore, smaller buildings that have low total use pay slightly more in electric costs.

Perhaps, depending upon DOER regulations, if an installation stands alone such as could occur in the watershed, the excess power beyond water treatment requirements could be used to offset other water department facilities that have \$.20 /KwH facilities. In addition, buildings with suitable site conditions for solar installations may consume in excess of 2300KwH per month. This is the case for the COA building. The month by month usage of energy for this building for the year investigated, exceeds the 2300KwH usage. Using PV Watts, the month by month production of electricity may be compared to the month to month usage by the building (see appendix). From this comparison it was determined that about 96% of the avoided electrical cost occurs at the lower energy delivery rate. Energy above this amount was distributed at a reduced rate. The reduced rate was approximately \$.03 per KwH below the rate charged for energy supplied at a rate over 2300 KwH per month.

Systems utilizing MTC rebates usually have a KwH meter to measure the production of the renewable energy to determine the system output and to evaluate the value of the RECs. If DOER regulations were to allow this meter to have its own connection to the distribution lines rather than through the energy meter existing at the site, this power through the use of virtual net metering could be assigned to buildings that use electricity in the lower end of the power usage range. This could result in a gain of an extra \$.03 per KwH. This will help pay for the installation and allow more sites to be fiscally viable for a PV solar energy installation.

4.16 FINANCIAL DETAILS OF MTC MODEL AND ASSUMPTIONS

Previously in this report and by using the MTC model, the Committee learned about the effects of different parameters on solar finances such as loan terms and energy inflation rates. The appendix presents the detailed parameters used for the various MTC model runs. The MTC model requires a number of inputs to be completed by the user prior to running an analysis of a solar system. Table 4.3 below shows a list of its inputs.

Table 4.3: MTC Model Inputs

Fields in MTC Model
System Size
Total System Cost
MTC Rebate
Amount of Loan
Loan Interest Rate
Loan Period
Net Capacity Factor
Annual Production Degradation
Project Life
Electricity Revenue (Avoided Costs)
Electricity Revenue Annual Adjuster (Inflation)
REC Revenue
REC Revenue Annual Adjuster
REC Revenue Term
Annual Operation and Maintenance (O&M) Cost
Annual O&M Adjuster
Future Inverter Replacement Cost
Inverter Life

The items inputs listed are self explanatory except for the REC revenue and the capacity factor. The REC revenue source was previously addressed in this report. The net capacity factor is a measure of the energy produced by the

system in a year. The net capacity factor is the ratio of the energy expected to be produced in one year and the energy that could be produced in one year if the system ran continuously at its rated output.

4.17 EFFECTS OF ELECTRICITY REVENUE AND ELECTRICITY REVENUE ANNUAL ADJUSTER

The COA proposal, with modifications, was used as the basis to demonstrate both solar finances and the advantage of stretching the loan period so that the revenue stream provides greater coverage of the project expenses. The COA feasibility study is the only proposal that was available to the committee for examination. The report provided a cost for a solar installation and key details about the installation that have been the basis for a lot of committee work and investigation.

The COA billing (included in the appendix) shows that the COA building exceeds the 2300 kWh break point as previously discussed. Above this point delivery charges are reduced as compared to below this point. This lower cost electricity diminishes the projects financial performance.

The following scenarios were developed by the committee using the MTC model and updated energy costs and changes from the Green Communities Act. They include a greater rebate, and the extended loan term. The model runs are representative of conditions as existing on 02/07/2009. Five scenarios (A-E) were run on the MTC financial model. The scenario results are included in the Appendix. These five scenarios have been identified as Scenarios A, B, C, D, and E. The parameters entered were based on the known values or best estimates of the values at the time that they were run. They are based on our knowledge as of the first months of 2009. The Scenarios show the cumulative cash flow in graphical form for each of the Scenarios.

- Scenario A uses an avoided cost of \$.17/ kWh and a revenue adjuster of 3% /20yr loan
- Scenario B uses an avoided cost of \$.20/ kWh and a revenue adjuster of 3% /20yr loan
- Scenario C uses an avoided cost of \$, 17/ kWh and a revenue adjuster of 5% /20yr loan
- Scenario D uses an avoided cost of \$.20/ kWh and a revenue adjuster of 5% /20yr loan
- Scenario E uses an avoided costs of \$.20/ kWh and a revenue adjuster of 3% /10yr loan
- All other parameters used are identical for each scenario.

Scenario A clearly shows that the cash flow generated from the solar PV installation is sufficient to pay the expenses until it is time to replace the inverter in year 15. The maximum out of pocket cost occurs in year 15 due to the inverter replacement and is about \$6400. For the first 14 years and the last 10 years electricity is obtained at low cost. The accumulated cash flow is a little over \$40,000 without the reduction needed to evaluate the Scenario at the current value. This represents the finances for the COA building using relatively conservative inputs.

Scenario B shows the benefit of increasing the avoided cost revenue by 17.6% by using \$.20/kWh as compared to the \$15 revenue of Scenario A. The cash flow is sufficient to pay all expenses for the life of the project. The accumulated cash flow is about \$65,000 without the reduction needed to evaluate at the present value. As pointed out, this represents a case where the avoided cost may be applied to a facility that uses less than 2300 kWh's per month.

Scenario C shows the benefit obtained if the avoided cost increases by 5% annually as compared to the 3% annual increase in Scenario A. The cash flow is again sufficient to pay all expenses for the life of the project. The accumulated cash flow increases to the larger value of \$90,000 without the greater reduction needed to obtain present value. This represents what is believed to be too high an adjuster under present financial conditions.

Scenario D shows the benefit of increased revenue of avoided cost and increased annual percentage increase in annual avoided cost as compared to Scenario A without any reduction to present value.

Scenario E was run with the same general conditions as Scenario B, but with a 3% electricity revenue adjuster and a ten year loan period. This scenario results in a loan of \$48,560 as do all other scenarios but with an out of pocket cost of \$15,000 and an accumulated cash flow of \$75,000 without adjustment to present value. This case illustrates the possible gain in total savings by paying off the loan in a shorter time at the expense of an out of pocket cost. As pointed out, we are still awaiting the detailed definition from DOER of the new terms - particularly net metering. This scenario still uses \$.20/KwH electricity. Scenario E shows an out of pocket cost of about \$15,000 in year 10. This compares to the \$20,000 in the original proposal. The cost flow turns positive in year 14. There is one negative cost flow year in year 15 due to inverter replacement and then the cost flow is positive for the remaining years.

It should be noted at this time that the replacement of the inverter was timed to follow the default time shown by MTC. The original proposal used year 16 to replace the inverter and a system life of 30 years. This avoids the necessity to represent the replacement in the last year of life. Obviously this would not happen unless considerable extra life was expected. In this particular case it might also have avoided the negative cash flow in year 15.

4.18 SOLAR PHOTOVOLTAIC RECOMMENDATION

Throughout the Committees term many alternatives were discussed for a municipal solar installation. As described in this report, many were tested using the MTC model. As part of this process the Committee has recognized that if the output of a solar array matches a standard size inverter it optimizes the cost of the system. The solar PV system recommended for the Council on Aging building met this criteria. As we worked, the environment for renewable energy underwent continuous change. The cost of electricity went up and then down. The Commonwealth changed the ground rules with the Green Energy Act. And the final rules for virtual net metering allowed under this act have not yet been issued.

When considering solar photovoltaic installation, some of the following parameters are key items to consider:

1. The total cost of the system.
2. The available rebate
3. The amount of the required loan or investment.
4. The loan interest and term.
5. The avoided electrical costs.
6. The REC revenue and time duration.
7. The replacement cost of the inverter.

Specifically important are, the amount and term of the loan and the revenue stream from the avoided electrical costs and from the sale of the RECs. The work reported demonstrates the importance of the revenue stream, the expected inflation and the term of the loan. The longer the time period of the loan, the smaller is the loan payment and the greater the opportunity to install a system that pays for itself from the revenue stream.

Scenario F was run to determine the viability of a PV solar installation for the COA building. Scenario F, G and I; all introduced in this report are contained in the appendix. It was discovered that in addition to the MTC rebate that Orleans also earned a renewable energy grant. This grant currently lists a value of \$15,000 available to Orleans. Scenario F uses both of these funds to minimize the 20 year loan and the latest full value of avoided electrical cost together with a favorable REC revenue term of 15 years. Inflation is forecast at just 2%. The financial model shows favorable results for this condition. Cash flow is positive for every year. The accumulated cash flow in 30 years is \$50,905 that has a present value of \$33,858. The viability of this analysis is dependent on how virtual net metering is defined. If the electricity can be assigned not to the COA building, but to town buildings that use less than 2300 Kwh per month then the avoided cost will provide the larger revenue stream that was used. Also for this scenario, the inverter was replaced in year 16.

Scenario G was run with the \$.014 cost per Kwh that corresponds to the charge for the COA building. The cash flow was positive for all years except for years 16 through 20 due to the replacement of the inverter and the cessation of the REC revenue in year 16. The maximum out of pocket cost of \$ 2,626 in year 16. The accumulated cash flow was \$30,147 in year 30 without a PV correction. This result is considered by the committee as satisfactory. The first 20 years of electricity had a maximum out of pocket cost of just \$ 2,626 and year 30 showed a significant payoff. The 15 year term for the REC income should be confirmed before proceeding with this scenario.

Scenario H was run with the same conditions as scenario F but with a 10 year REC term. Cash flow was positive for every year and a 30 year savings of \$ 47,944 was realized.

Finally Scenario I was run using the same terms as F except using the expected rebate of 4.5 \$/watt. Cash flow did not turn positive until year 23. The maximum out of pocket cost of \$ 10,377 occurred in year 18. The uncorrected accumulated cash flow in year 30 was \$ 28,799.

The Committee recommends monitoring the Department of Energy Resources (DOER) process that will provide “regulations” for the legislation that is the Green Communities Act. Every opportunity should be explored to net meter power at the highest possible rate for a Town installation.

Loan rates were never tested in any of our scenarios but the Green Communities Act may provide opportunity for low interest loans at rates of less than 4% for solar projects. If Orleans continues to show progress towards becoming a qualified “Green Community” these low cost financing options may be realized. The Committee recommends seeking the best rates and 20 year borrowing for any municipal solar project considered.

Based on the above points the Committee recommends that the Council on Aging building be considered a candidate for a solar photovoltaic array on its rooftop. The Committee recommends an array size, similar to the one proposed by petition, of less than 15,000 Watts. The Committee recommends financing the project over 20 years as allowable under the Green Communities Act. The Committee also recommends, if possible, installing a net metering facility independent of the COA building in order to distribute the power to other municipal accounts at \$.17 per Kwh. The committee recommends following the evaluation of buildings and verification measures outlined in this report. All of the financial parameters should be confirmed when the final GCA regulations are published.

The Committee would also like to recommend that solar arrays be considered as part of new municipal construction or major remodeling in the future. Advances are occurring in both the cost and the efficiency of solar modules. In addition it is expected that solar modules may be developed that can replace shingles. This should further reduce costs. This approach with new or renovated buildings would make it more desirable than trying to

retrofit existing roofs for the arrays. By incorporating an array in new construction it has the potential to be more compatible with building design, extend roof life, and not void roof warranties. Typically solar projects have a 30 year life span and municipal buildings are built with 30-50 year roof warranties. By coordinating the two the Town may discover efficiencies in the installation, lower cost, and coordinated warranties.

5 REGIONAL OPPORTUNITY: CAPE AND VINEYARD ELECTRIC COOPERATIVE (CVEC)

The Cape and Vineyard Electric Cooperative (CVEC), was established on September 12, 2007, was organized pursuant to MGL c. 164 Section 136 (the “Electric Cooperative Statute”). Based on its Bylaws restricting its membership to governmental entities and requiring it to operate as an instrumentality of its governmental members, the CVEC is authorized to purchase, acquire, distribute, sell, supply or dispose of energy or energy-related services to wholesale or retail customers. The major purposes of the CVEC is to develop and/or own renewable electric generation facilities, and to procure and/or sell long-term electric supply or other energy-related goods or services including Renewable Energy Certificate (REC) contracts at competitive prices. The CVEC’s goals are to acquire the best possible market rate for electric supply, support the development of renewable energy resources, provide improved quality of services and reliability to customers, and promote conservation and energy efficiency.

The CVEC has several significant capabilities: (1) the CVEC can develop and/or own renewable energy or distributed generation projects; (2) it can borrow funds or negotiate low-cost loans to finance renewable energy projects; (3) it can issue bonds and notes; (4) it can purchase electric power in the wholesale market; (5) it can enter into long-term contracts to purchase power or for other energy-related purposes. Thus the CVEC has the tools to effectively compete in the electric power supply market for member governments.

The CVEC, in developing renewable energy projects, plans to take advantage of the Massachusetts Renewable Portfolio Standard (RPS) which mandates that electricity suppliers increase the percentage of their renewable energy sourced supply from 4% in 2009 to 11% in 2016 (increasing 1% each year). This requirement of the Restructuring Act will result in new construction of renewable energy facilities in Massachusetts and the rest of New England. The Cooperative also plans to sell Renewable Energy Certificates to the Cape Light Compact for the benefit of all of its customers.

5.1 COOPERATIVE TAX-EXEMPT STATUS

In a Private Letter Ruling issued in June 2008, the IRS confirmed the tax-exempt status of the CVEC, which is crucial to its organizational viability. The CVEC’s income will be exempt from federal income taxation, primarily because it derives from “an essential government function” and because the CVEC is “an instrumentality of its government members”. Interest on bonds and notes issued by the CVEC will be excluded from gross income determinations, and consumers purchasing RECs through the Cape Light Compact Green Program will be eligible for a tax deduction. The IRS considers the CVEC to fulfill “an essential government function” because it is an organization created to pool the casualty risks of its governmental members, thereby helping to protect their financial integrity. Further, the IRS has ruled that the provision of a diverse, competitively priced and more environmentally beneficial power supply is a public purpose.

5.2 COOPERATIVE FINANCING

The Cooperative plans to seek lower cost, long-term financing from established sources of the federal government for the development of renewable energy projects in member towns. In particular, the Rural Utilities Service (RUS) of the Department of Agriculture provides low rate long-term loans to cooperatives for utility-scale projects or for several smaller sized renewable energy projects packaged together. The CVEC has already established contact with this agency and has assessed its financial backing as promising. The Cooperative Finance Corporation has also been contacted; that agency funds individual energy projects by cooperatives on a competitive basis. In addition,

the Cooperative and the Cape Light Compact have arranged for “Community Wind Program” financing support from the Massachusetts Technology Collaborative in the form of a long-term RECs contract which will enable the Compact to purchase RECs produced by the Cooperative at a competitive fixed price (\$40) in order to help stabilize electricity rates for the Compact’s 170,000 customers. Financing for the development of a project sited in a member town through the Cooperative will not only be available at cheaper rates because of lower-cost federal loans, but it will also result in no impact on the host town’s debt exposure.

The CVEC ultimately can limit the financial exposure of member towns to their pledges and any shared assessments deemed necessary. The goal is to have the power purchase agreements resulting from all developed projects be the primary financial support mechanism provided by member towns to the CVEC. For secondary support, and only to support development of a specific renewable energy project, member towns may also be assessed for capitalization financial backing on a municipal load pro rata basis.

5.3 ALLOCATION OF BENEFITS FROM COOPERATIVE PROJECTS

Each renewable energy project financed, developed and/or owned and operated by the CVEC in a member town will entitle that host town to net meter up to the total amount of the member town’s municipal load, with a maximum contribution of 90% of project electricity output. If any of the 90% output remains after host town net metering, that excess capacity would be shared by the other member towns of the CVEC on a municipal load pro rata basis. The remaining 10% of project output would go to the CVEC. The host town for a CVEC project would also receive negotiated lease payments for the facility’s use of municipal land.

Town membership in the CVEC provides for two other types of meaningful benefit. The professional and technical expertise of the staff that will be assembled should be able to assist host towns in the vital role of planning. Additionally, the Cooperative will maintain a central contract for purchasing, administration and O&M services which should significantly constrain the overall costs of these kinds of services for all renewable energy projects undertaken.

5.4 COOPERATIVE RESPONSIBILITIES

Each renewable energy project financed or developed by the CVEC, while the Town is a member, makes members responsible for that project on the pro rata share as described in the CVEC documents. Specifics on both benefits and responsibilities of membership were detailed by the CVEC in their document *RIGHTS AND OBLIGATIONS OF MEMBERSHIP IN THE CAPE & VINEYARD ELECTRIC COOPERATIVE, INC. dated August 11, 2008.* If indeed members do not agree to provide the pro-rata financial contribution/backstop required for specific projects the Member would be terminated. Finally the CVEC can levy a financial assessment upon its members. This can be done only upon obtaining the affirmative vote of a majority of the members of the Executive Committee or Town Meeting.

5.5 DETAILS OF COOPERATIVE MODEL

A CVEC financed and developed project proposed by a member town shifts the financing responsibility and development/O&M costs away from the host town. It provides the host town with 90% of the projects net metered energy output and provides the town with lease payments (cash flow) for the project’s site. Staff and technical planning expertise are also available to the host town.

In evaluating the many factors involved in whether a renewable energy generation project proposed should be owned and operated by the Town or the CVEC limited progress was made. The Town requested a detailed financial

pro-forma for a CVEC wind facility on Site 1 in the watershed. The Committee felt if provided, a direct comparison could be made between the two ownership models. Unfortunately, no CVEC pro-forma was made available and no direct comparison was made. However, when considering the wind project for Site 1 a comparison was discussed and is listed in this report. A table of that comparison is detailed in the Wind section of this report.

The Committee believes that the generic financial model for the CVEC is to utilize the benefits granted to the Town under the Green Communities Act. The CVEC will negotiate lease terms with member Towns and negotiate a reduced fixed price for energy with a CVEC project Town for a period of time. This CVEC negotiated energy contract will be enough to pay annual debt service (CVEC responsibility) and provide low fixed cost energy to the project Town. It should be noted that any REC (Renewable Energy Certificates) revenue received, as well as the 10% of generated electricity not available to the host Town provides the CVEC with its necessary revenue stream.

5.6 RECOMMENDATION

During the past several months the Renewable Energy/Wind Power Committee has spent a considerable amount of time attempting to understand the pros and cons of membership in the Cape & Vineyard Electric Cooperative. The Committee has listened to presentations by representatives from the Cooperative, requested and obtained detailed information concerning the Rights & Obligations of Membership, and finally participated in a public discussion (sponsored by the Orleans Citizen's Forum) to further understand how membership in the Cooperative might benefit the Town of Orleans.

Early on in the process, the Committee recommended that the Board of Selectmen "seek authorization at the Annual Town Meeting to enter into discussion to potentially join the Cooperative". The Selectmen agreed and presented Warrant Article 36 for consideration at the Town Meeting on May 13, 2009. The summary statement in the Warrant noted that the purposes of the cooperative include developing and/or owning renewable electric generation facilities, procuring and /or selling long term electric supply or other energy-related goods and services, including renewable energy certificate contracts, at competitive prices to member communities, and to consumers within member communities.

Article 36 was unanimously approved on May 13, 2009.

Some of the benefits of joining the Cooperative include:

- Financing large scale renewable energy projects with no burden on the Town's debt obligations.
- Potential benefits from CVEC developed projects (as host town or as a member at large)
- Access to low cost financing from the Rural Utilities Service that is specific only to Electric Cooperatives.
- Bring professional and technical expertise to develop projects that will benefit all members.
- Cooperative membership is not irreversible; we can withdraw membership at any time.
- Membership provides us an opportunity to participate in the decisions affecting what projects are initiated around us.

Based on the above, the Committee therefore recommends that the Board of Selectmen proceed with all actions necessary (including consultation with Town legal counsel), complete the application process, and finally, join the Cape & Vineyard Electric Cooperative

6 ORLEANS' ENERGY FUTURE

How Orleans can react responsively to the onset of global warming, our dependence on foreign oil and the opportunity for renewable energy.

In the energy arena, energy demands have resulted in a continuing increase of carbon (via carbon dioxide CO₂) into the atmosphere. This increase in carbon dioxide (CO₂) has been forecast to result in a continuing temperature rise that will also cause a rise in the sea levels and result in detrimental effects to the planet. Considering these forecasts and a National desire for energy independence from the current foreign sources of oil; the Committee recommends a responsive program for the Town and the citizens of Orleans.

How would this conclusion apply to a municipality like Orleans? It would show up in most every aspect of town government, both now and on into the coming five decades. Here are some examples:

- Energy demand could increase in part due to the need for increased conditioning of air, water and wastewater.
- Energy efficiency and reliability programs could be hard-pressed to respond; all at a time when energy prices could be growing.
- Sea-level rise (and shore line retreats) could stress local demands on land use management under pressure to allow waivers on building-lot allowances.
- Drinking water tables could be threatened by rising salt water, which could disable some wells, lessen the volume of available potable water, and force regional drinking water supply problems.

Therefore, the Orleans Renewable Energy/Wind Power Committee recommends that Orleans continue to have a Committee dedicated towards the topic of renewable energy. To this end, the Committee recommends to the Board of Selectmen (BOS) that the existing Committee be extended for an additional three months (September 20, 2009) or until a permanent Committee can be established, whichever is sooner. The Committee also recommends the new Committee be established with a broad scope of duties. The following are some of the key tasks that the Energy Committee should consider:

1. Assist with the identification of energy efficiency upgrades (using both new and old Energy Star efforts) to municipal facilities and equipment including the transportation fleet.
2. Advance Orleans towards becoming a qualified Green Community in order to provide access to Green Community grants and funding opportunities for renewable energy projects.
3. Identify current and future Town facilities to be served by future Town and or regional energy projects.
4. Assist with the development of Town and or regional energy projects.
5. Provide and promote broad energy education in cooperation with regional government and organizations, the business community, non-profit organizations as well as the general public (to include energy efficiency measures for the home, e.g. high efficiency home heating and hot water supply, solar assist for hot water and electricity, Energy Starr appliances, energy efficient lighting and other such opportunities.

Members of the Orleans Energy Committee should be appointed by the Board of Selectmen for two or three-year terms, initially staggered. The Energy Committee should be composed of 5 members and 2 alternate members. The Committee also suggests that a liaison from the BOS be appointed to guide and support the actions of the new committee. Citizens who possess knowledge, experience or interest in energy efficiency/conservation and alternative forms of energy, including but not limited to: photovoltaic, solar thermal, wind, tidal, geo-thermal or methods/technologies that will improve the efficient use of energy by the town, should be considered for appointment.