University of Delaware

Technical Analysis for On-Site Wind Generation

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DISCLAIMER

This report is presented in response to the contract between the University of Delaware and Sustainable Energy Developments, Inc. on 3 March 2008. The information and analyses presented herein is based on wind development best practices, commercially available information and a preliminary analysis of University of Delaware infrastructure; SED makes no guarantees, expressed or implied as to the actual outcome of the processes described in this report.

ACKNOWLEDGEMENT

Richard C. Gross P.E. prepared Section 4, Electrical System Impact Study and AWSTruewind, LLC provided wind resource data correlation that aided in the completion of portions of Section 2, Wind Resource Assessment. Duffield Associates provided input in Section 5, Buildability specifically relating to soil conditions at the identified wind turbine locations and subsequent foundation design.

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REPORT SUMMARY

The University of Delaware campus located in Lewes, DE (UD-Lewes) has the positive characteristics necessary for the development of an on-site wind generation project. Sustainable Energy Developments, Inc. (SED) identified the two most developable locations for a wind project that would use wind generated electricity to directly offset the purchase of electricity from the campus' utility company. The two sites have been examined in detail with regards to key aspects of wind power development and the results of this study show that both of these sites are capable of hosting a successful project. After completing a thorough technical feasibility study, SED recommends that the University move forward with the design and construction phase for a 1.5MW project at the site identified as Location 1.

Wind Resource Assessment and Turbine Output Modeling: For the purposes of this analysis, SED created a computer model with the industry standard Wind Atlas Analysis and Application Program (WAsP) using the GE 1.5 Mega-watt (MW) wind turbine. Inputs to the WAsP model included wind data collected for a one year period, correlated by AWS Truewind LLC, the wind turbine power curve and a roughness and elevation map of the region. The following tables show a summary of the WAsP output for this model at both sites.

	Rated Output	Rotor Diameter	Hub Height
GE SLE 1.5MW	1500kW	77m (252.6ft)	80m (262.5ft)

Potential Turbine Location	Mean Wind Speed at Hub Height	Annual Energy Output
Location 1	6.74 m/s	4,023,375 kWh
Location 2	6.66 m/s	3,937,000 kWh

Site Analysis: Only properties owned or controlled by the University of Delaware, or the State of Delaware in Lewes were contemplated as potential turbine locations. The available properties that provided the best wind climate were identified and a turbine site was chosen after applying a number of development criteria including but not limited to; permitting requirements; manufacturer requirements; interconnection; buildability; and overall project cost. Locations 1 and 2 were determined to be the most developable sites based on this criteria.

Wind Generated Electricity Value: SED used the wind turbine electrical output in combination with UD-Lewes' electrical consumption data in order to determine how much of the wind-generated electricity would be used by UD-Lewes and the resulting effect to the value of wind generated electricity. Based on assessment of current utility tariffs for the Lewes Board of Public Works, SED assumed that excess generation from the wind turbine would not be net metered. The current data suggests that the wind generated electric value for the GE 1.5MW wind turbines is $0.09380. It is expected that a rise in retail electric rates and an increase in electric usage at UD-Lewes will increase this wind generated electric value over time and further strengthen the economic benefit this project would yield.

Electrical System Impact Study: SED commissioned Richard C. Gross, P.E, to perform a site visit and consult on an electrical interconnection plan for the UD-Lewes project. Utilizing Mr. Gross's input, SED determined a detailed plan and total cost for interconnection of the GE 1.5MW wind turbine for either location to be $473,000.

Buildability: Installation of a GE 1.5MW wind turbine at the site will require a degree of access route upgrades and site preparation in order to construct. Additionally, a foundation that includes deep pilings will be necessary due to the subsoil conditions at the potential turbine locations.

Permitting: SED performed a detailed overview of permitting and regulatory requirements that a wind turbine installation at UD-Lewes would require. All applicable federal, state and local regulations were looked at and the process for securing necessary approvals is provided. Potential turbine Location 1 appears to present a more straightforward process for obtaining permitting approvals. Turbine Location 2 is in close proximity to wetland areas and could trigger permitting requirements through the U.S. Army Corps of Engineers.

Development Budget Timeline and Total Capital Cost: Detailed design and construction budgets were created for the GE 1.5MW wind turbine from wind industry knowledge, past experiences and site visits. The following chart shows design and construction budgets for this wind turbine.

	Location 1	Location 2
Total Design	$235,485	$235,485
Total Construction	$4,318,673	$4,569,014
Total Project Cost	**$4,554,158**	**$4,804,499**

SED recommends an aggressive timeline for project development with the entire design and construction process being completed within 20 months of contract execution.

Economic Analysis: The turbine output predictions, current wind generated electricity value and total capital costs were compiled to produce unlevered pro-formas for the GE 1.5MW turbine at Location 1. The following chart shows the economic returns for this turbine in a baseline scenario of 3% inflation rate that includes $1.4 million dollar appropriation the University of Delaware received from the Federal Budget (FY 2008).

Turbine Size	IRR % (equity only)	Payback Term (Years)	20 Year Savings
GE 1.5 MW	13.23%	7.43	$6,826,932

The GE 1.5MW turbine demonstrates tremendous economics in this baseline scenario. This result will ensure that whichever financing option is pursued by UD, that the financial benefit will be substantial. Additionally, SED recommends this turbine for the UD-Lewes site project because the load match will allow the project's economics to benefit more from an increase in usage and/or an expected rise in electric rates.

Financing Ownership and Operations: In addition to the above considerations, it is important to determine the most cost effective ownership and financing scenario for a wind turbine at UD. The third-party, debt financing and municipal bonding models were explored. As was demonstrated in the base line scenario, any of these options will provide significant financial benefit and the University should determine which scenario would be most ideal.

Conclusion & Recommendation: This project possesses many of the aspects necessary for the successful development of a GE 1.5MW on-site wind project. The process of final site selection, questions associated with property ownership, preparing a permitting toolbox, formally filing for necessary permits and gaining the support of the local population should commence at the earliest possible date. The project team expects that the necessary approvals will be obtained, therefore, additional design/development tasks can be performed in parallel with the permitting process.

SITE ANALYSIS CONSIDERATIONS

Section 1

In order to site a wind turbine at the University of Delaware – Lewes campus (UD-Lewes) a number of factors must be taken into account.

Land Ownership: For the purposes of this analysis, SED has only considered sites on land owned by UD or by the State of Delaware that is in close proximity to UD-Lewes property (1500 feet (ft) or less). From this assessment SED has determined that the best location to install a turbine is on land currently owned by the State. The University has received initial assurances from the State that a project at this location will be feasible.

Proximity to Residences and Adjoining Properties: The placement of wind turbines in relation to residences is important particularly because of sound and shadow flicker considerations. In this analysis, SED has only considered sites at which a wind turbine will not expose residents to unnecessary sound or shadow flicker. To ensure that the residents of Lewes are not adversely affected, SED used a setback of 550 meters ((m) (1804 ft)) from all residences.

Proximity to Occupied Buildings: There are currently no buildings in close proximity to the contemplated turbine locations that would pose any major issues, however UD should keep in mind the placement of the wind turbine in any future expansion efforts. Should future buildings be planned SED recommends they are set back a distance greater than 110% of the total tip height of the turbine from the turbine location, or 130.4m (428ft).

Buildability: The issues regarding the ability to build/construct a project have been examined in detail in Section 5 of this report. The findings of this analysis, especially in regards to site access for the oversized vehicles used to transport the equipment to the installation location, were incorporated into the selection of appropriate sites.

Proximity to Wetlands: Because of the UD campus in Lewes' low elevation and proximity to the coast, the location of wetlands must be considered when choosing a turbine location. Although the available wind resource is generally greater near the coast, building in or near wetlands introduces additional permitting and building costs. For this reason, SED has focused on available inland sites.

Manufacturer Siting Requirements: GE, which manufactures the turbine used in this analysis, employs numerous requirements on where and how GE turbines are sited, including certain setbacks from residences and public roads. Currently the setback requirement from public roads and unoccupied buildings is 600 feet.

1.1 SITE ANALYSIS

SED considered a wide variety of potential sites for the installation of a wind turbine at UD-Lewes at the beginning of this task, six of which are shown in Figure 1-1 below. These sites were selected based on the factors outlined above as well as interconnection points, site access, permitting, total project costs, wind resource and locations of interest indentified by UD staff. The goal of this assessment is to identify the best location with consideration of these factors and developing a project in the shortest time feasible. The turbine used for this siting analysis was a GE 1.5 Mega-watt (MW) wind turbine.

<u>Figure 1-1 Satellite Image Showing Potential Turbine Locations</u>

A rubric was developed based on these considerations and additional characteristics listed below, that identified the pros and cons of an installation at each potential location. Certain factors were weighed higher than others in these considerations, particularly permitting and regulatory considerations. Sites with greater negatives were removed until the three most viable locations were identified. While each site presents unique positive and negative characteristics, locations 1, 2 and 3 appear to be the most favorable of all sites considered. In addition to the characteristics listed above the following considerations were examined:

1. Permitting and Regulatory – special consideration of turbine proximity to areas that would present serious challenges to successful permitting, including proximity to residences and wetlands.
2. Interconnection – there are still unknowns associated with what the Lewes Board of Public Works (LBPW) will allow in regards to interconnection and net metering. The proximity and relative location to the two largest loads (Smith and Cannon) was considered, as was the need to cross public ways with any utility lines.
3. Project Cost – Due to buildability or interconnection issues, SED attached rough cost multipliers to sites where these factors appeared to require additional consideration. The higher costs associated with a site has weakened its standing in this analysis.
4. Wind Resource – Due to the large scope of the land being investigated and the minor difference of the wind resource between coastal and inland sites, SED looked at each site with this factor in mind. Since this difference was minimal (less than 10%), its weight was small compared to other factors and did not remove a site from consideration.

For the purpose of this study, SED will focus on Locations 1 & 2 as the primary locations for the siting of the wind turbine. Location 3 is a viable alternative, but it would not meet the wind turbine manufacturer's criteria for siting due to proximity to public ways and unoccupied buildings. Additionally, its close proximity Location 1 means that the analysis would be easily adaptable to this location.

Location 1 is located on property owned by the State of Delaware Division of Parks and Recreation that was conveyed to the State in July of 2002 by the University of Delaware. The potential turbine location is within an area used for depositing dredge spoils. Consideration was given to ongoing activity in the area and would need to be sited so as to not conflict with this activity. The site's elevation is 3 meters (10 feet amsl) and is located on the west edge of the spoils area. The GE 1.5MW wind turbine at this location would meet the manufacturer requirements and would be appropriate distance from residential areas.

Pros: Meets manufacturer siting requirements; ease of interconnection behind largest meters at UD-Lewes; adequate area for staging and erection; access to site should not be an issue beyond some access road improvements; closer to coastline and thereby has somewhat better wind resource than other locations.

Cons: Could disrupt ongoing activities at location; would limit further usage of this location for other purposes; Land is owned by Delaware Parks and Recreation; effect of development near dredge spoils area.

Location 2 is also located on land owned by Division of Parks and Recreation. The site's elevation is less than 1 meter (6 ft. amsl) and is located at the southern edge of the dredge spoils area. The site is forested by scrub-shrub, which contains trees of 6 meters (20 feet) or less. Installation of a wind turbine at this site would require a 2300 ft. wire run, which is somewhat longer than what would be required for other sites.

Pros: Meets manufacturer siting requirements; Ease of interconnection behind largest meters at UD-Lewes; Adequate area for staging and erection; Upland area (not marsh or fill) with layer of topsoil.

Cons: Potential permitting issue regarding wetlands; will require clearing for staging/erection and access road; distance from coast marginally affects wind turbine output; Land is owned by Delaware Parks and Recreation.

Location 3 is also on land owned by State of Delaware Parks and Recreation and is located on the eastern edge of the dredge spoils area. The site's elevation is 3 meters (13 feet amsl). If a wind turbine were installed at location 3, the wire run would be less than 1,000 ft.

Pros: Ease of interconnection behind largest meters at UD-Lewes, shortest wire run; adequate area for staging and erection; access to site should not be an issue as some clearing already exists;

Cons: Does not meet manufacturer siting requirements, as it's closer than 600 feet to proposed public road; would limit further usage of this location for other purposes; Land is owned by Delaware Parks and Recreation; will require some clearing and access road improvements

Figure 1-2 Image Showing Locations 1, 2, and Met Tower Site

The other three sites (4, 5 and 6) considered by SED in this study posed significant development hurdles regarding the criteria listed above. Though these locations may have qualities that make them more desirable than the other three; namely, proximity to coast and wind resource, their negative aspects, in SED's opinion, outweighed any benefits. That being said, certain developments or conditions could alter this conclusion and SED would gladly investigate these areas further, should the need arise. These sites could also be considered, if UD were to decide on pursuing an additional wind turbine installation(s).

Location 4 is located on property owned by the State of Delaware Division of Parks and Recreation. The site's elevation is less than 1 meter (6 ft. amsl) and is located within a wetland area west of the campus. A

GE 1.5MW at this location would meet all of the required setbacks and would be an appropriate distance from residences.

Pros: Meets manufacturer siting requirements; ability to interconnect behind largest meters at UD-Lewes; adequate area for staging and erection; closer to coastline and thereby has somewhat better wind resource than other locations considered.

Cons: Land is owned by Delaware Parks and Recreation; located in a marsh area and would likely require permitting from Army Corps of Engineers; Access to site is currently non-existent and would require building of an access road and staging area.

Location 5 is located on property owned by the University of Delaware, the only potential site identified that has this designation. The turbine location is within a wetland area, across Pilot Town Road from the main campus. The site elevation is less than 1 meter (6 ft. amsl) and would not meet manufacturer requirements for distance from public ways, occupied buildings or residences.

Pros: Property is owned by the University; closer to coastline and thereby has somewhat better wind resource than other locations.

Cons: Does not meet manufacturer siting requirements; poses difficulty for interconnection behind largest meters and could require crossing water to reach closest meter at the Research Center; limited area for staging and erection; local permitting issues and community acceptance issues due to proximity of residences to the northeast; federal permitting requirements as its located in wetland area; Difficulty in accessing site, would require development of access road and staging area.

Location 6 is located on property owned by the State of Delaware Division of Parks and Recreation and is designated a state park (Beach Plum Island State Park). The turbine location would be on a coastal area and the elevation is ~1 meter or less. A GE 1.5MW at this location would meet all of the required setbacks and would be an appropriate distance from residences.

Pros: Closer to coastline and thereby has somewhat better wind resource than other locations.

Cons: Difficulty of interconnection, would require significant costs to interconnect to grid; limited area for staging and erection; would require building long access road from north that would cut directly through the park; state permitting issues and community acceptance issues due to turbine location in state park; federal permitting requirements as its located near designated wetland area; Subsurface conditions are shoreline deposits, consisting mainly of sand.

WIND RESOURCE ASSESSMENT AND TURBINE OUTPUT MODELING

Section 2

In order to calculate the anticipated Annual Energy Production (AEP) of a GE 1.5MW wind turbine at the University of Delaware-Lewes campus (UD-Lewes), SED used the wind industry standard modeling tool Wind Atlas and Analysis Program (WAsP). For this analysis, SED input model data from the GE 1.5 MW SLE wind turbine with a hub height of 80 m (262.4ft) and a rotor diameter of 77 m (252.6ft). While other turbines may be used at this site, the AEP from this turbine at all sites considered can be used as a guide.

2.1 WIND TURBINE SELECTION AND OUTPUT CALCULATION

SED determined that a GE 1.5MW turbine is appropriate for this site, as it matches UD-Lewes load profile. The GE 1.5MW turbine is highly reliable, commercially available, and is one of the most widely used wind turbines in the world.

Figure 2-1 – Turbine Considered for UD Site

Manufacturer/Model	Rated Output	Rotor Diameter	Hub Height
GE 1.5MW SLE	1.5 MW	77m (252.6ft)	80m (262.5ft)

To determine the output of a wind turbine on the site, SED used the industry standard wind modeling software, WAsP, created by the Danish National Laboratory. The model was created by licensed and certified user: *Scott Abbett, Sustainable Energy Developments, USA using WAsP version: 9.01.0000*.

In order to accurately calculate the output of the three wind turbines at the UD site, the WAsP model considered:

- A full year (8760 hours) wind data from a meterological (met) tower, corrected and correlated by AWS Truewind[1]
- The primary turbine site identified in Section 2 of this study
    - Turbine Site – 485757.4 E, 4292846.0 N (UTM, WGS84)
- A terrain map of the USGS 7.5 minute Quadrangle-Lewes, DE
- A roughness map for the USGS 7.5 minute Quadrangle-Lewes, DE
- The power curve of the GE1.5MW wind turbine with a 77m (252.6ft) rotor diameter and a 80m (262.5ft) hub height

[1] AWS is a LLC based out of Albany, New York specializing in wind resource assessment for over 20 years.

2.2 MET MAST LOCATION AND SUMMARY

Figure 2-2, below, shows the location of the met tower installed by SED in relation to the top three sites being considered for the installation of a wind turbine at UD-Lewes. The met tower site is approximately 800 ft. from Location 1 and approximately 1900 ft. from Location 2.

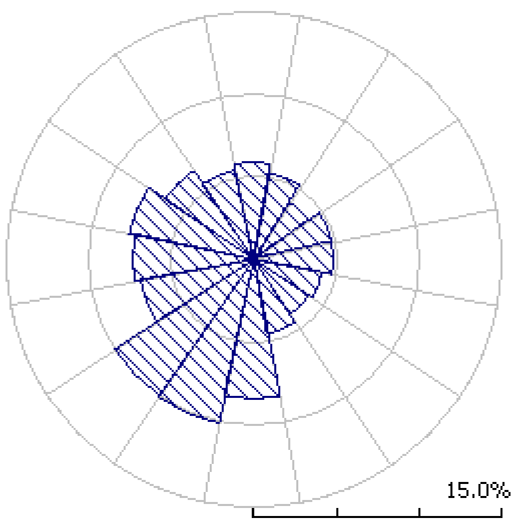
Figure 2-2 Met Mast Location

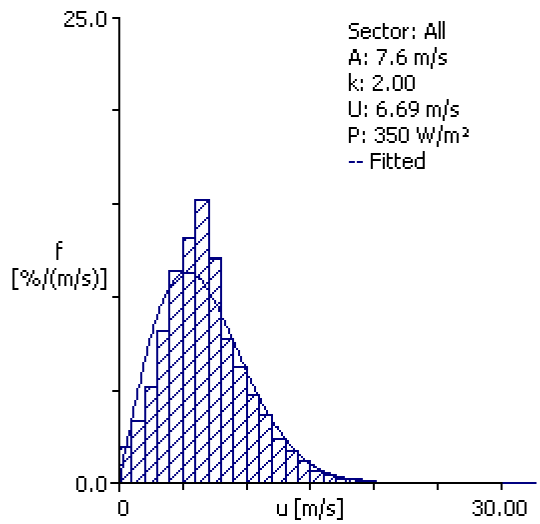
Figure 2-3 Met Mast Information

Data Correlated By	AWS Truewind
Height	80m
Location	485920.4 Easting (WGS84)
Location	4292985.0 Northing (WGS84)
Elevation	2 m
Mean Wind Speed At 80m AGL	6.75 meters per second (m/s)

Figure 2-4 provides the Wind Rose and Weibull Distribution for the 80m (262.4ft) wind data. The Wind Rose (left) describes wind direction. As depicted, the wind at the UD-Lewes site is most frequently experienced between the southwestern sectors. The Weibull Distribution (right) is a description of the percentage of time in a year where certain wind speeds will exist at the met tower location. A similar distribution is used in conjunction with the wind turbine manufacturer-supplied power curve to determine the electrical output from a wind turbine at a particular site.

Figure 2-4 80m Wind Rose (Left) and Weibull Distribution (Right)

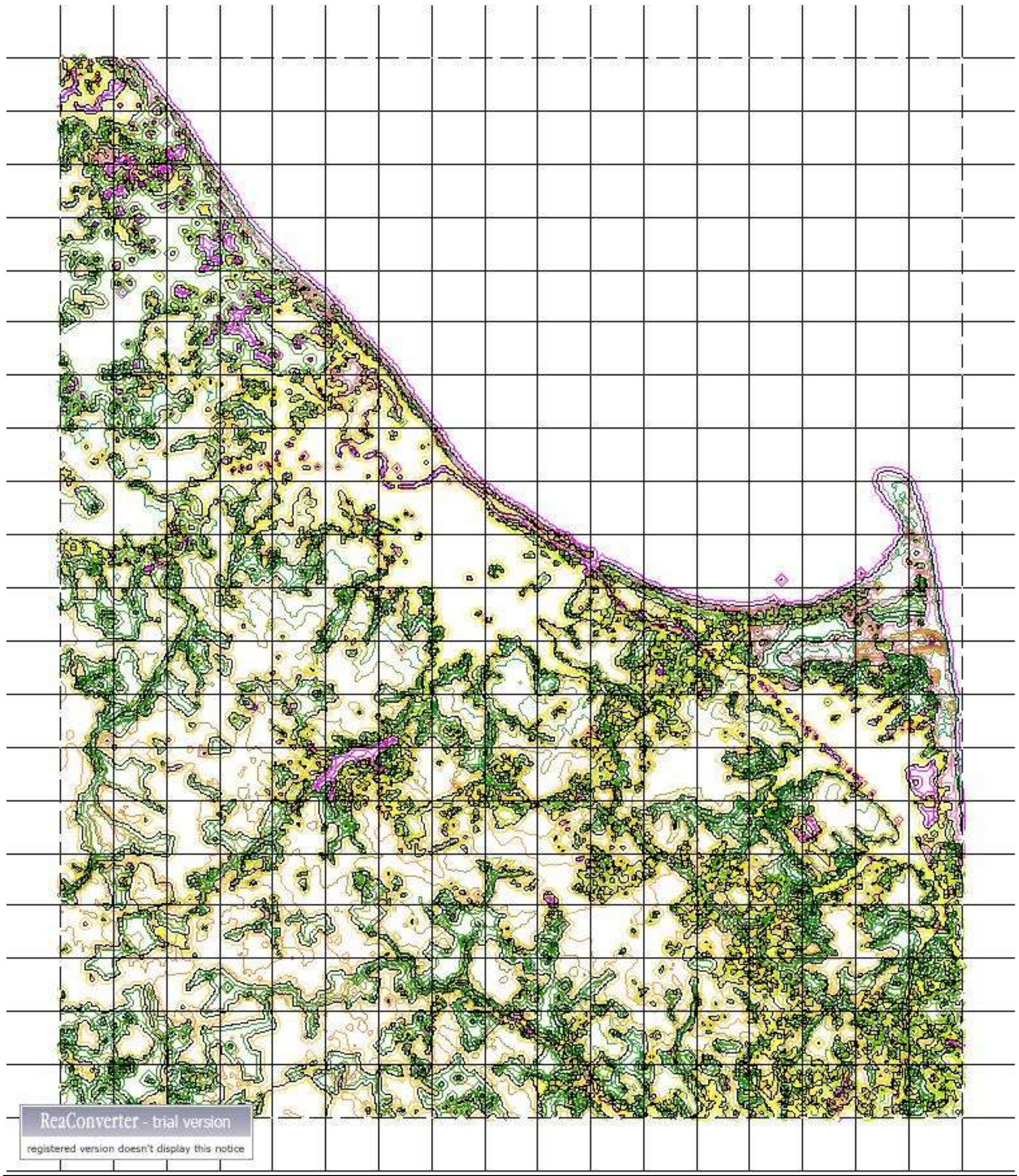




2.3 TERRAIN AND ROUGHNESS MAPS

WAsP uses terrain and roughness maps to accurately determine the way the wind flows over the identified site. These maps are also input into the model in order to calculate the local site effects. The terrain map is a topographical representation of the area using 3.048m (10ft) contour lines. The roughness map is a representation of the surface roughness and/or ground cover in the surrounding area based on the WAsP roughness classification system. The area was modeled using a 13,015m (42,700 ft) by 13,038m (42,776 ft) digital elevation model. The terrain map comes directly from the US Geological Survey (USGS) and the roughness map used in this model was obtained from AWS Truewind. Figure 2-5 is a representation of both the terrain and roughness maps for the site and surrounding area. The terrain map contours range from green (0m / 0 ft.) to purple (22m / 72 ft.) and the double lines represent changes in roughness classifications.

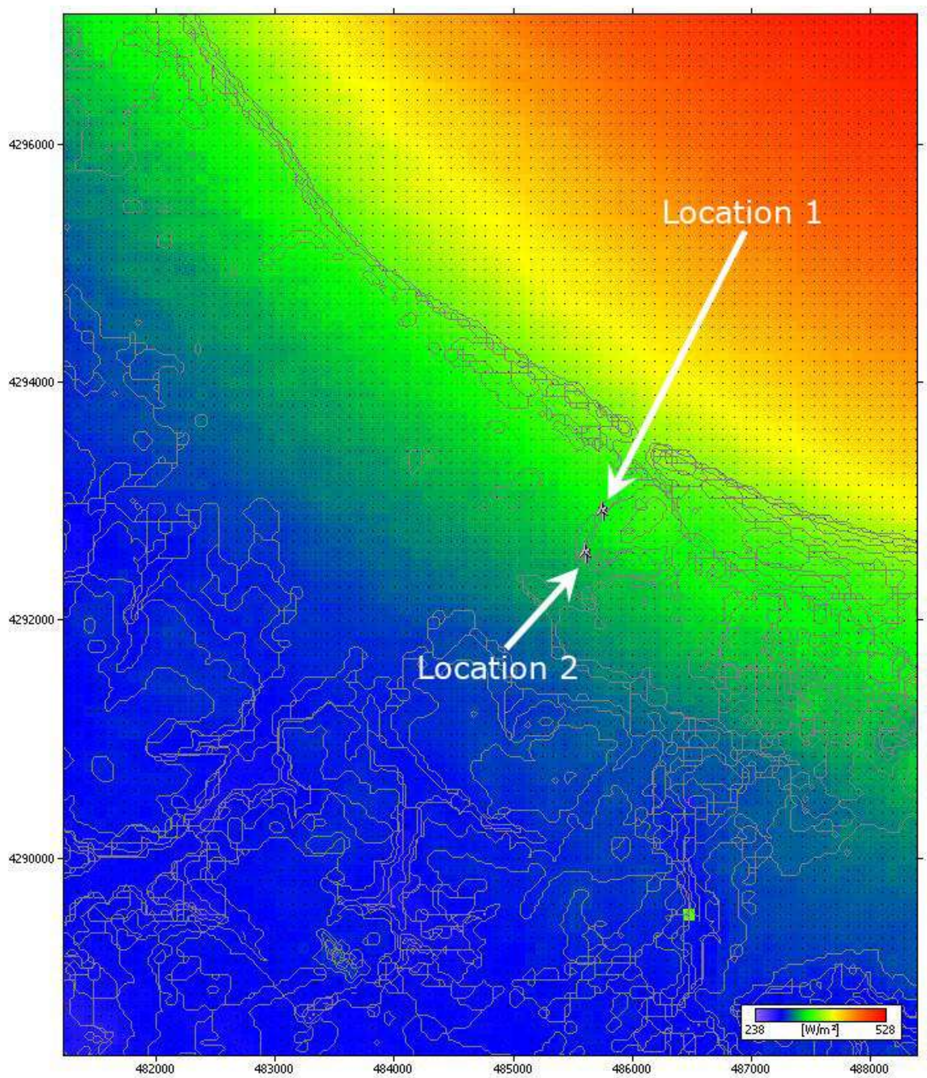
Figure 2-5 Terrain and Roughness Map



2.4 RESOURCE GRID

A resource grid can be generated within WAsP to show the wind power density over a given area. While the resource grid should not be relied on for an exact prediction of power density in a specific location, it does provide a relative and comparative overview of power density at and near a given site. Figure 2-6, below, shows a resource grid, as well as both sites considered in this analysis. The wind power density at 80m ranges from 238 W/m^2 (blue) to 528 W/m^2 (red). Based on this resource grid, the available wind resource at location 1 appears to be somewhat better than the wind resource at location 2.

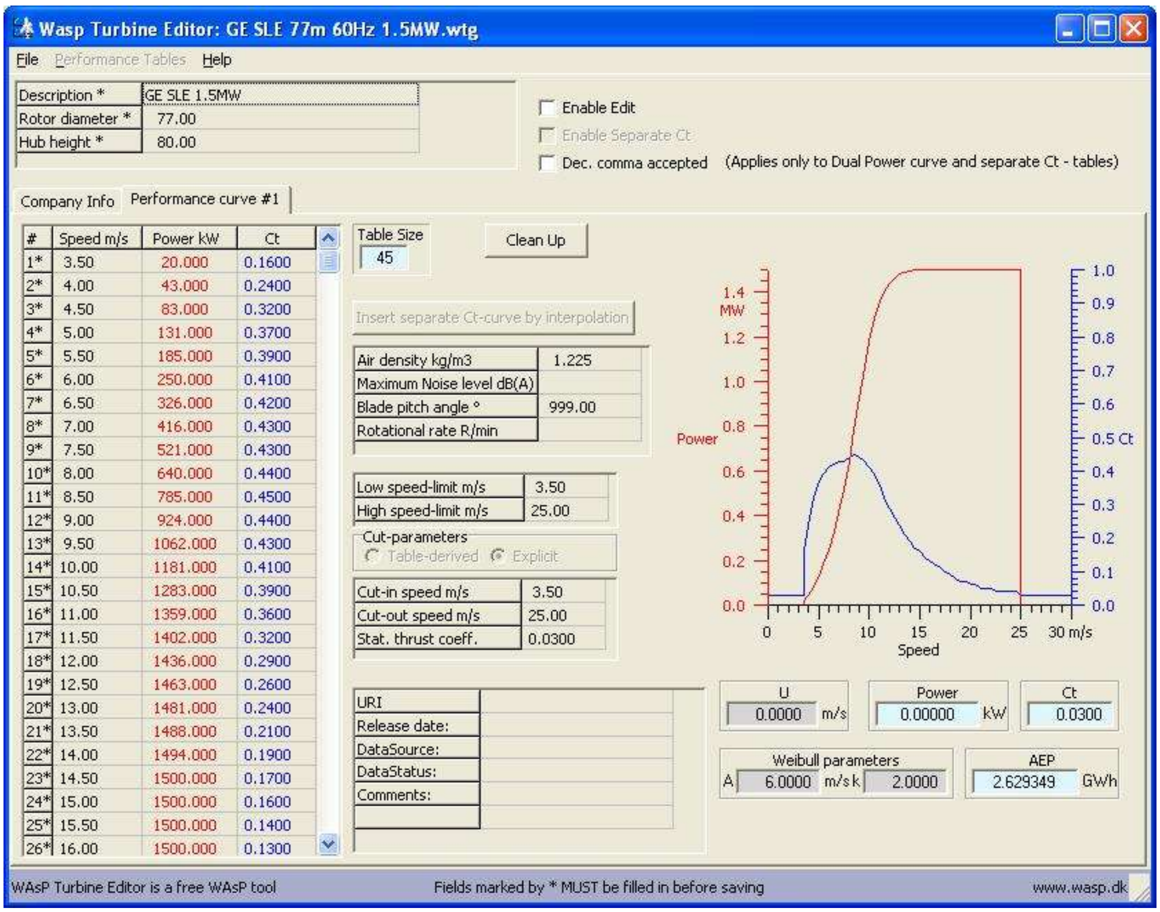
Figure 2-6 Resource Grid



2.5 WIND TURBINE POWER CURVE

In order for the WAsP model to work properly it is important to have an accurate power curve for the turbine being considered for the project. A power curve indicates how much power the turbine will produce at different wind speeds. For this model, SED used the manufacturer-supplied power curve for the GE 1.5MW wind turbine with a 77m (262.5 ft) rotor diameter.

Figure 2-7 Power Curve – GE 1.5MW



2.6 SUMMMARY OF MODEL RESULTS

Once all of the data inputs were completed, the WAsP model was run for the GE 1.5MW wind turbine at both potential turbine locations. Figures 2-7 is a summary of the results for this model run.

Figure 2-8 WAsP Model Summary – Run 1 – Location 1

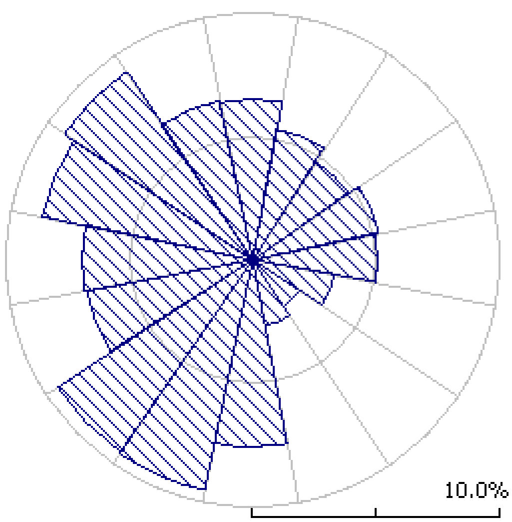
Model Run	Turbine	Mean Wind Speed at Hub Height (m/s)	Mean Power Density (W/m^2)
1	GE 1.5MW	6.74	353

Figure 2-9 GE 1.5 Model Results – Location 1

Site	Location [m]	Turbine	Height [m]	Net AEP* [GWh]	Wake loss [%]
Primary Turbine Site	(485757.1,4292846.0)	GE SLE 1.5MW	80	4.350	0.0

**AEP stands for Annual Energy Production (Gigawatt hours)*

The combined (omnidirectional) Weibull distribution predicts a gross AEP of 4.424 GWh and the emergent (sum of sectors) distribution predicts a gross AEP of 4.350 GWh. (The difference is 1.69%)



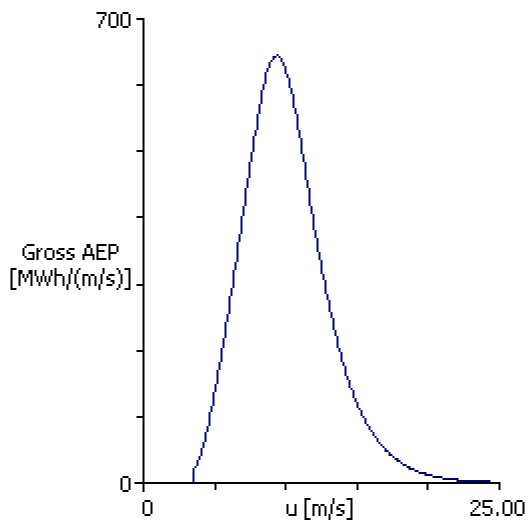


Figure 2-10 WAsP Model Summary – Run 2 – Location 2

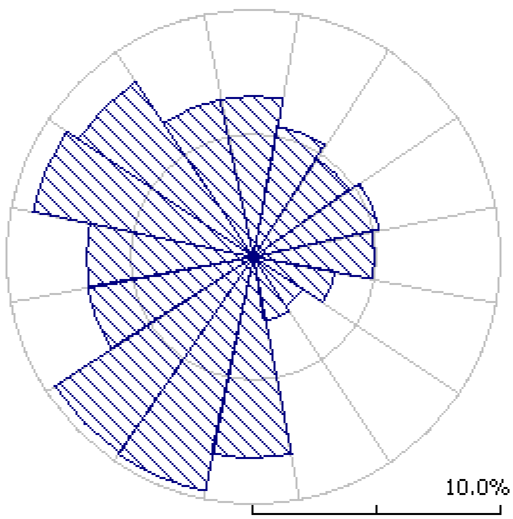
Model Run	Turbine	Mean Wind Speed at Hub Height (m/s)	Mean Power Density (W/m^2)
2	GE 1.5MW	6.66	339

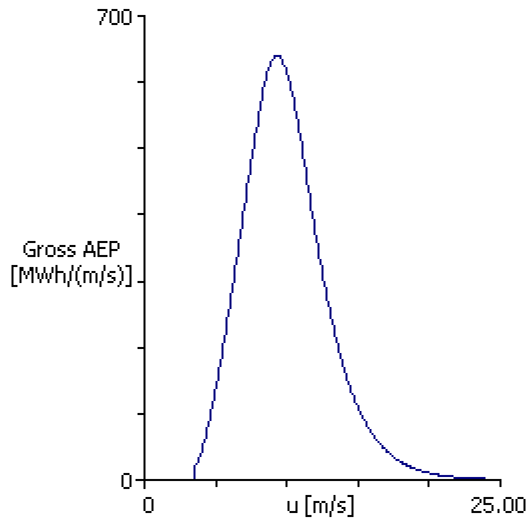
Figure 2-11 GE 1.5 Model Result – Location 2

Site	Location [m]	Turbine	Height [m]	Net AEP* [GWh]	Wake loss [%]
Alternate Turbine Site	(485613.1,4292494.0)	GE SLE 1.5MW	80	4.256	0.0

**AEP stands for Annual Energy Production (Gigawatt hours)*

The combined (omnidirectional) Weibull distribution predicts a gross AEP of 4.321 GWh and the emergent (sum of sectors) distribution predicts a gross AEP of 4.256 GWh. (The difference is 1.53%)





2.7 FINAL TURBINE OUTPUT CALCULATIONS

WAsP calculates turbine output assuming that the wind turbine is available 100% of the time and that 100% of the power generated makes it into the grid or is otherwise consumed on-site. Realistically, a wind turbine experiences downtime for various reasons and not every single unit of power produced at the turbine's generator makes it to the grid or is consumed on-site. The following are considerations used in determining how much power a wind turbine will actually supply.

Guaranteed Availability: This comes from the turbine manufacturer and is the percentage of time that the wind turbine is guaranteed to be in working condition and takes into account the downtime for scheduled maintenance activities.

Electric Line Losses: The power generated at the turbine needs to run through a certain distance of electric lines and two different transformers before it connects to the grid or is consumed at a facility. Through these conversions, a small portion of power will be lost.

General Losses: This category includes downtime due to icing, other weather related events such as high wind speed events and unscheduled maintenance.

Grid Failure: Without the electrical grid operating normally, a wind turbine cannot produce power because it is an asynchronous/induction generator that initially requires electricity to generate its own electricity. Grid failure takes into account the time when the electrical grid is down due to scheduled or unforeseen events.

A total loss percentage was calculated taking all of these factors into account as can be seen in Figure 2-12.

Figure 2-12 Assumed Losses

Guaranteed Availability (98%)	2.0%
Electric Line Losses	2.0%
General Losses	2.5%
Grid Failure	1.0%
Total Losses	**7.5%**

Therefore the power produced by a turbine as calculated by WAsP needs to be reduced by 7.5%. Figure 2-13 shows the remaining calculations to determine power output of the GE 1.5MW turbine at the UD-Lewes site..

Figure 2-13 Final Output Calculations

Turbine	Location	Rated Power	GWh from WAsP	Final GWh (AEP –7.5%)
GE 1.5MW	1	1500kW	4.350	**4.024**
GE 1.5MW	2	1500kW	4.256	**3.937**

UTILITY-DERIVED ELECTRICITY VAULE

Section 3

3.1 UD-LEWES ELECTRICITY DATA

In order to understand the UD-Lewes electrical usage, SED analyzed cumulative consumption data for the 12 months leading up through November 2008 (Figure 3-1). In order to provide a conservative analysis, SED has assumed that electrical usage will not significantly increase from its current levels over the projected 25-year lifespan of a wind turbine. If electricity usage at UD-Lewes does increase over the life of the wind turbine, the wind generated electricity value will exceed the value predicted in this report.

UD-Lewes has numerous accounts with its electricity supplier, and the rates charged per kWh vary by account, and by total usage. Because of the proposed wind turbine installation site, it seems most appropriate to interconnect the turbine so that it offsets electricity usage at the Smith and Cannon Labs. For the purposes of this analysis, SED has assumed that a wind turbine at UD-Lewes will only offset electricity usage at these facilities. If electricity generated by a wind turbine can be used to offset the electricity usage of all university facilities, the wind generated electricity value will exceed the value predicted in this report. It should also be noted that this report does not assume that net metering will be possible for this project. For more information on net metering, see section 3.2, below.

3.2 NET METERING

Net metering allows customers with their own renewable electricity generation capabilities to quantify the flow of electricity through the use of a bi-directional meter. When the customer's generation exceeds their use, it can be used to offset electricity supplied by the utility at times when the demand of the customer is greater than what can be supplied by the on-site generator. The meter accounts for these situations and dependent upon the State regulations and size of the generator, the utility is required to purchase this excess energy at the customer's retail rate. Absent the introduction of net metering, any excess electricity generated by a wind turbine would be sold to the utility at the wholesale rate, which is significantly lower than the retail rate.

The State of Delaware requires net metering of customer generators with rated capacity not to exceed 2MW for all utilities and electric cooperatives that compete outside their service territory. The Lewes Board of Public Works (LBPW) is the electric utility for UD-Lewes. Municipal utilities and electric cooperatives are not required to net meter any customer generator with a rated capacity above 500kW, but are encouraged to do so[2]. It is unknown at this point whether or not the LBPW would allow UD-Lewes to net

[2] The Delaware Code; Title 26; Public Utilities; Chapter 10: Electric Utility Restructuring; 1014. Public purpose programs and consumer education.

meter, particularly considering their amount of usage and the generation of this size machine. SED recommends that the project team continue engaging with the LBPW on this issue and stress the merits that this project will yield to the University and community. If the University is permitted to net meter electricity generated by a wind turbine, the value of electricity produced by the turbine will be significantly greater than what is predicted in this analysis.

3.3 USAGE AND RATES

Electricity use at the Smith and Cannon Labs is billed at a rate of 14.5023 cents for the first 5,000 kWh and 12.4123 for each additional kWh used per month. Because the electricity consumption of these two facilities is significantly higher than 5,000 kWh per month, and in order to provide a conservative estimate of the value of electricity produced by a wind turbine at the site, this analysis uses the lower rate for the value of wind-generated electricity.

While it would seem that the value of electricity produced by a wind turbine at the UD-Lewes site could easily be calculated by multiplying the estimated number of kWh produced by the turbine by the cost the University pays per kWh, this is not the case. In order to determine the value of electricity produced by a wind turbine at the UD site, SED built a model taking the following into account:

- The average combined electricity demand at both facilities
- The retail cost of electricity
- The wholesale cost of excess electricity sold back to the utility
- An estimate of the period of peak use at the facilities (9AM-5PM)
- That demand between 9 AM and 5 PM will be approximately 20% higher than the average demand for a given month, and that demand between 5PM and 9AM will be approximately 12% lower than average monthly demand.
- Hourly wind speed data and an estimate of hourly electricity production for a one year period (8760 hours)

The above information was necessary to make an accurate estimate of wind generated electricity value because approximately 51.5% of electricity generated is not expected to be used on-site. Instead, it will be sent to the grid, and the University will be paid for this electricity at the wholesale rate.

Figure 3-1 shows combined electricity consumption data for the Smith and Canon Laboratory buildings for 12 months leading up November 2008.

Figure 3-1 12-Month Electricity Usage Data

Month	Total Use – kWh
Dec-07	268,000
Jan-08	281,760
Feb-08	261,600
Mar-08	255,200
Apr-08	220,480
May-08	257,920
Jun-08	318,400
Jul-08	383,520
Aug-08	389,440
Sep-08	270,400
Oct-08	277,280
Nov-08	232,960
Totals	3,416,960

The average combined electricity demand for both facilities is calculated by adding the kWh used at each facility during a given month and dividing by the number of hours for that month. The average combined demand for both facilities is shown in Figure 3-2, below:

Figure 3-2 Average Demand by Month

Month	Average Demand
Dec-07	360
Jan-08	378
Feb-08	363
Mar-08	332
Apr-08	328
May-08	335
Jun-08	442
Jul-08	515
Aug-08	450
Sep-08	388
Oct-08	385
Nov-08	323

The retail cost of electricity at the Smith and Cannon research facilities is approximately 12.4123 cents per kWh. This includes a variable monthly charge referred to as the PPCA, or the "Power Production Credit Adjustment." While this rate is variable, in the year ending in November 2008, for which data is available, this charge ranged from 1.6220 cents to 2.4630 cents per kWh. The average PPCA charge for the year ending in November 2008 was 1.9545 cents. In order to arrive at a final electricity cost SED added this average PPCA charge to the University's fixed electricity cost of 10.4578 cents per kWh. It should be noted that PPCA data was not available for December 2007 and October 2008. For a monthly breakdown of PPCA rates, please see figure 3-3, below:

Figure 3-3 PPCA Charge by Month

Month	Average Charge
Dec-07	not available
Jan-08	0.016270
Feb-08	0.018220
Mar-08	0.018220
Apr-08	0.021620
May-08	0.024630
Jun-08	0.024580
Jul-08	0.019460
Aug-08	0.018400
Sep-08	0.017830
Oct-08	not available
Nov-08	0.016220

3.4 WHOLESALE POWER SALES

The value of wind-generated electricity and the resulting project economics will in part be dependent upon the arrangement that is negotiated to sell excess wind-generated electricity which is not net metered.

In order to estimate the value of electricity sold to the grid, SED examined historical wholesale rate data for the last year, which is available through the PJM Transmission. Figure 3-4, shows these rates as well as an average wholesale rate for the past 12 months. It should be noted that these rates are rounded to the nearest cent.

Figure 3-4 Wholesale Supply Rates

Month	Average Day Ahead Location Marginal Pricing ($/MWh)
January 2008	$63.20
February 2008	$64.23
March 2008	$59.80
April 2008	$61.91
May 2008	$55.41
June 2008	$68.90
July 2008	$77.85
August 2008	$81.15
September 2008	$66.42
October 2008	$61.91
November 2008	$58.59
December 2008	$63.65
Average Wholesale Rate	$65.27

As shown in Figure 3-4, the average wholesale supply rate can change dramatically from one month to the next, but for the purposes of this analysis, SED will use the average wholesale rate for electricity supply for the last 12 months, which is $65.27 per MWh, or $0.06527 per kWh.

It is important to note that if electricity usage at the University increases, less electricity will be sold to the grid at the wholesale rate. As a higher percentage of a wind turbine's generation capacity is used to offset retail electricity rates, the economic returns of a wind turbine project will increase.

In order to project the retail costs/rates of electricity for UD-Lews over the 25-year lifespan of the wind turbine, SED examined four different potential electricity escalation rates: 0% (electric rates do not inflate), 3% (standard inflation of electric rates), 5% (electric rate rise above standard inflation) and 8% (electric rates rise well above standard inflation). The rates used for the economic analysis are based on a starting point of $0.124123/kWh and are detailed by year in Figure 3-5.

Figure 3-5 Projected Electricity Rates

Year	0% Inflation	3% Inflation	5% Inflation	8% Inflation
2010	0.124123	0.127847	0.130329	0.134053
2011	0.124123	0.131682	0.136846	0.144777
2012	0.124123	0.135633	0.143688	0.156359
2013	0.124123	0.139702	0.150872	0.168868
2014	0.124123	0.143893	0.158416	0.182377
2015	0.124123	0.148209	0.166337	0.196968
2016	0.124123	0.152656	0.174654	0.212725
2017	0.124123	0.157235	0.183386	0.229743
2018	0.124123	0.161952	0.192556	0.248122
2019	0.124123	0.166811	0.202183	0.267972
2020	0.124123	0.171815	0.212292	0.289410
2021	0.124123	0.176970	0.222907	0.312563
2022	0.124123	0.182279	0.234052	0.337568
2023	0.124123	0.187747	0.245755	0.364573
2024	0.124123	0.193380	0.258043	0.393739
2025	0.124123	0.199181	0.270945	0.425238
2026	0.124123	0.205156	0.284492	0.459257
2027	0.124123	0.211311	0.298717	0.495998
2028	0.124123	0.217650	0.313653	0.535678
2029	0.124123	0.224180	0.329335	0.578532
2030	0.124123	0.230905	0.345802	0.624815
2031	0.124123	0.237833	0.363092	0.674800
2032	0.124123	0.244967	0.381247	0.728784
2033	0.124123	0.252317	0.400309	0.787086
2034	0.124123	0.259886	0.420325	0.850053

To gain a better understanding of power consumption at specific times throughout the year, SED created a spreadsheet model that assigned the average demand values to all 8760 hours of the year. For each month, SED assigned an average on-peak and off-peak demand, broken down on an hourly basis. Therefore every hour of the year has an average demand value assigned to it which can be compared to the turbine output over time.

3.5 WIND DATA

The WAsP model, described in Section 1, accurately predicts annual turbine outputs but is unable to give estimations of production over time. Therefore a model was created to predict the time based output of a wind turbine. The same wind data that provided the basis for the WAsP computer model was used for this analysis.

Analysis Location

For the original technical analysis, a WAsP model was used to extrapolate the wind data across the UD site so the output of a wind turbine could be obtained from locations other than the original met tower location. Because WAsP does not have the ability to give time-based hourly data at different locations this spreadsheet analysis was performed for a turbine at the actual met tower location so the original time-based data could be used.

Wind Turbine Output Calculation

A spreadsheet model was built to determine the output(kW) of the wind turbine for each hour of the year analyzed. In order to accomplish this task, wind speed bins were created for the wind turbine power curve at 1 m/s intervals and the wind turbine output value for each bin was estimated as the mean of the highest and lowest values of the bin. For example the value for the 4 m/s to 5 m/s bin is the halfway point between the output at 4 m/s and the output at 5 m/s. Figure 3-6 shows the bin calculation for the GE 1.5MW wind turbine power curve. The spreadsheet assigns an output to every hour of the year depending on the average wind speed for that hour. The outputs for each hour of the year can then be summed to produce the total yearly production for the turbine.

Figure 3-6 Manufacturer Supplied Power Curve for the GE 1.5MW and Bin Information for Spreadsheet Model

Wind Speed (m/s)	Power Curve Output (kW)	Bin	Value of Bin (kW)
4	43	4 to 5	87
5	131	5 to 6	190.5
6	250	6 to 7	333
7	416	7 to 8	528
8	640	8 to 9	782
9	924	9 to 10	1052.5
10	1181	10 to 11	1270
11	1359	11 to 12	1397.5
12	1436	12 to 13	1458.5
13	1481	13 to 14	1487.5
14	1494	14 to 15	1497
15	1500	15 to 16	1500
16	1500	16 to 17	1500
17	1500	17 to 18	1500
18	1500	18 to 19	1500
19	1500	19 to 20	1500
20	1500	20 to 21	1500
21	1500	21 to 22	1500
22	1500	22 to 23	1500
23	1500	23 to 24	1500
24	1500	24 to 25	1500
25	1500	25 to 26	1500

This spreadsheet model is not ideal for making turbine production estimates since there is a significant amount of rounding (up and down) that occurs. However, given the large sample size of 8,760 hours it is expected that the results will produce a relatively accurate depiction of time based turbine production, which is the purpose of this analysis.

The spreadsheet model was run and compared to the results of the WAsP Analysis from Section 1. Figure 3-7 shows the results of this comparison. It should be noted that the numbers below do not reflect anticipated losses of 7.5% -- this will be discussed at the end of this section.

Figure 3-7 Comparison of Production Estimates from WAsP Model and Spreadsheet Model

Turbine	Hub Height	Yearly kWh Outputs from WAsP	Yearly kWh Outputs from Spreadsheet
GE 1.5 MW	80	4,350,000	4,301,007

3.6 RESULTS

With a full 8760 hours of wind turbine production and UD-Lewes demand estimates, the final step is to calculate the blended rate, or the wind generated electricity value for each kWh generated by each turbine considered. In order to calculate the blended rate, SED has considered the following:

- Turbine Model
- Anticipated electricity production
- Anticipated electricity demand at UD
- Percentage of turbine generated electricity that offsets retail rates
- Percentage of turbine generated electricity sold back to grid at wholesale rate

Figure 3-8 Production and Demand Outputs from Spreadsheet Model

Turbine	Production	Demand	Total to Grid	Purchase From Utility	To Grid Wholesale
GE 1.5 MW	4,301,007	3,352,755	51.5%	1,268,754	2,217,005

To determine the blended rate for each turbine, SED first determined what percentage of electricity production will be used on-site, as well as the percentage of electricity sold at wholesale rates to the utility company. These percentages of total production for each turbine are shown in Figure 3-9.

Figure 3-9 Electricity Generation by Rate Class

Turbine	Used On Site	Sold At Wholesale
GE 1.5 MW	48.5%	51.5%

The percentages of total production for the turbine have been used in conjunction with the established on-peak, off-peak and wholesale rates to determine a weighted, blended rate. The weighted, blended rate represents the estimated wind generated electricity value of each kWh generated by a wind turbine at UD-Lewes. These rates are shown in Figure 3-10.

Figure 3-10 Final Results for To-Grid Spreadsheet Analysis

Turbine	Total Production	Total Demand	Total To Grid	% to Grid	Blended Rate
GE 1.5	4,301,007	3,352,755	2,217,005	51.5%	$0.09380

The blended rate presented in Figure 3-10 represents the value of wind-generated electricity in Year 1 of the project.

INTERCONNECTION ANALYSIS

Section 4

SED commissioned Richard C. Gross, P.E, to perform an electrical interconnection analysis for the UD-Lewes project. Mr. Gross was tasked with analyzing the existing electrical supply facilities, and exploring the implications of interconnecting a GE 1.5 MW SLE wind turbine.

4.1 RECOMMENDED INTERCONNECTION PLANS

Based on SED's experience with similar wind turbine projects in addition to the analysis and input provided by Mr. Gross, two potential interconnection options have been developed and are applicable to both potential turbine locations. SED’s recommendations will minimize interconnection costs while maintaining the integrity of the existing UD-Lewes and utility electrical systems.

Option 1: Dedicated Utility Interconnection

Interconnection Option 1 includes all of the necessary protective equipment (relays and disconnects) and interconnection of the turbine into the existing distribution circuit at 12.4 kilovolts (kV). The 690 Volt output of the turbine is: “stepped-up” to 12.4 kV by a new, 1750 kilovolt-amp (KVA) three-phase transformer; transferred below ground via three, #2 AWG, aluminum cable to a new primary riser pole; transferred above ground and interconnected into the existing overhead primary circuit near LBPW Pole#78393. The new turbine circuit will be primary metered by a new bi-directional, 4-quandrant meter at the new overhead circuit near LBPW Pole#78393. See Appendix B for the one-line diagram developed by Mr. Gross illustrating this approach.

The approximate cost of interconnecting a GE 1.5 MW SLE wind turbine as laid out by Option 1 is $473,000. This cost includes a new, 1750 KVA three-phase ”step-up” transformer at the base of the wind turbine, along with new underground conduit , transmission cable, electrical poles to carry overhead transmission cable, bi-directional revenue meter, grounding system, and all utility required protective equipment. This option is preferred because it requires no modifications to existing electrical equipment, includes a dedicated utility feed to the turbine, as generally required by GE, and is the less expensive of the two approaches. The feasibility of this approach, however, will depend mainly on the LBPW net-metering determination/requirements that will be finalized through discussions with LBPW during the design phase of the project.

Option 2: Existing UD Circuit Interconnection

The second interconnection option includes all of the necessary protective equipment (relays and disconnects) and interconnection of the turbine at 12.4 kV into a spare terminal at the existing 5-way electrical junction located inside the existing Cannon Hall transformer vault. The 690 Volt output of the turbine is: "stepped-up" to 12.4 kV by a new, 1750 KVA three-phase transformer; transferred below ground via three, #2 AWG, aluminum cables ; and interconnected into a spare terminal at the existing 5-way electrical junction located inside the existing Cannon Hall transformer vault. A new primary revenue meter will be installed near LBPW Pole#78558 and will net-meter the wind turbine's electricity production and Cannon Hall electricity consumption. See Appendix B for the one-line diagram developed by Mr. Gross illustrating this approach.

The approximate cost of interconnecting a GE 1.5 MW SLE wind turbine into the existing UD-Lewes electrical system as laid out by Option 2 is $648,000. This cost includes a new, 1750 KVA three-phase "step-up" transformer at the base of the wind turbine, along with new underground conduit , transmission cable, new bi-directional revenue meter, grounding system, and all utility required protective equipment. As previously mentioned, GE generally requires a dedicated utility feed to its turbine. However, an agreement may be reached that allows for an exception to this requirement. Advantages of this approach include interconnecting behind the meter of Cannon Hall and utilization of the existing electrical infrastructure. The potential also exists to interconnect Smith Hall into this circuit and offset its electricity consumption along with Cannon Hall, maximizing the use of turbine generated electricity on-site. The decision to interconnect into the existing UD circuit will depend upon net-metering requirements of the LBPW, implications of potential upgrades, and reaching an agreement with GE.

BUILDABILITY
Section 5

The ability to successfully construct a wind turbine facility at University of Delaware Lewes Campus depends upon many factors. Transport and access routes to the site must be adequate to handle large vehicles and equipment such as wind turbine blades, large tower sections, and construction equipment. The size of the staging area necessary for the construction process varies depending upon the type of wind turbine, size of foundation, and surrounding and available area. Foundations for wind turbines can vary greatly depending upon subsurface conditions, type of wind turbine, type of tower, and engineering assumptions with regard to maximum forces on the wind turbine. For the purposes of this study, a GE 1.5MW (or equivalent MW class) wind turbine was considered and an analysis of the site characteristics was performed.

5.1 TRANSPORTATION

Transportation concerns include the ability to safely transport the wind turbine components to the construction site and to stage these components with adequate space for installation. Modern wind turbines are typically composed of several major components which originate in various locations all over the world. These components are usually delivered separately, and require professional transportation. The contracted transport company must obtain all necessary permits and approvals for transport of components from the port of delivery to the site. These include State and local approvals for transport including bridge, overpass and utility line thresholds/clearances. The delivery of each part of the wind turbine must be coordinated carefully with the project team and the wind turbine provider.

Due to the unique nature of wind turbine blade, nacelle, and tower transport, special attention needs to be paid to the shipping route in regards to tight curves, steep grades, and bridge capacities. The maximum weights and measures for the components of the GE 1.5MW, shown in Figure 5-1, should be used in transport survey determinations.

Figure 5-1 Transport Specifications of the GE 1.5MW*

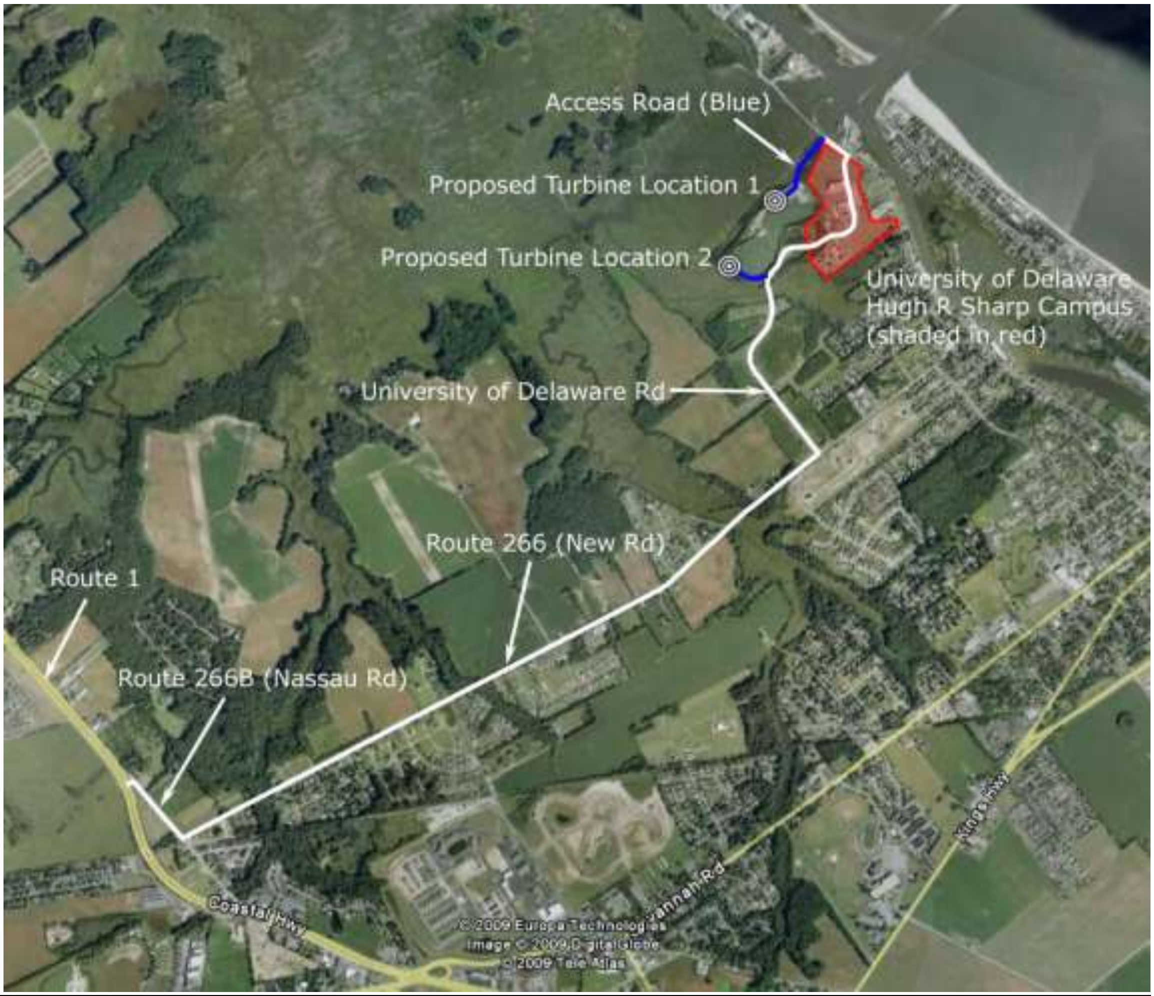
Maximum height of load:	4.5 meters (14.75 feet)
Maximum weight of load:	42 tonnes (92,500 lbs.)
Maximum length of load	37.5 meters (123 feet)
Maximum width of load:	4.5 meters (14.75 feet)

*Weights and measures do not account for trailer and transport equipment.

The equipment transport trucks and construction vehicles will need to reach the site safely and efficiently, unload all components and exit the site. This could require road improvements and modifications to ensure all turning radii are sufficient for the entire length of the access route and that the route is wide enough to handle both the wind turbine and transport equipment.

The recommended transport route to the selected site(s) will require little to no improvements to existing roads, but will, however, require access road upgrades and construction to allow for the transport and construction vehicles to reach the proposed turbine location(s). Starting from Route 1, transport vehicles will exit onto Route 266B (Nassau Rd) and turn promptly onto 266 (New Rd), heading NW towards the Lewes Campus. Transport vehicles will continue down Route 266 to the campus entrance at University of Delaware Rd. Getting equipment and construction vehicles to both the primary and secondary proposed turbine sites once on the campus will require the construction of a new access road or the upgrade of an existing access road. To reach the primary turbine site, vehicles will continue to the end of University of Delaware Rd, turn left onto to Pilottown Rd, and proceed into the existing access road leading into the dredge spoils area and to the turbine site. The existing dredge spoils access road could require potential upgrades, such as widening or compacting, in order to handle the equipment size and loads. To reach the secondary turbine location, an access road, approximately 20ft wide, will need to be constructed from University of Delaware Rd and built to withstand equipment size and loads. An aerial image showing the recommended transport route is shown in Figure 5-2.

Figure 5-2 Recommended Transport Route



Once the wind turbine components are transported to the project site, they must be safely unloaded, staged for construction, and erected. This area must be graded and compacted to allow for the safe and efficient assembly and erection of the wind turbine. The recommended access route and staging area for both potential turbine locations is depicted in Figure 5-3. Each proposed route will be the most effective in terms of minimizing alterations to existing infrastructure and minimizing cost.

Figure 5-3 Staging Area and Access Road

5.2 FOUNDATION AND GEOTECHNICAL CONSIDERATIONS

The type of foundation needed to construct a wind turbine varies significantly with subsoil, bedrock, groundwater, and other geotechnical conditions. Because of the unique nature of wind turbine foundations and extreme loads experienced, the size and cost of such a foundation can vary greatly. SED commissioned Duffield Associates to perform a preliminary geotechnical review of the proposed turbine locations and provide general recommendations regarding expected foundation types. This geotechnical review is included as Appendix F in this Report.

Surface soils at Proposed Turbine Location 2 consist of “upland formations” (aka “Scotts Corners Formations”), characterized by sand deposits with potential silt or clay veins, and extends approximately 15 feet below existing ground surface. Surface soils at Proposed Turbine Location 1 consist of “fill” soils and are a result of dredging activities in the nearby inlet. These “fill” soils consist of fine-grained silts and clays, are anticipated to extend from several feet to 20 feet deep, and are underlain by soils similar to Location 2. Underlying surface deposits at both locations’ is soil generally consisting of unconsolidated sands deposited in marine environments and extends on the order of 100 feet. Depth to bedrock is indicated to be in excess of 4,000 feet.

Due to sub-surface conditions described above, the use of a typical structural mat, or spread footing, foundation would result in an impractically sized foundation for the considered wind turbine. Therefore, a deep foundations systems utilizing drilled shaft or driven piles is proposed. This type of foundation consist of a thin spread footing style concrete block with piles or drilled shafts that extend deep into the subsurface. The anticipated depth of the shafts or piles at the IC site is approximately 100 feet. Such a foundation is typically found in marine sub-soils and utilizes the frictional or side resistance support from deeper, stiffer soils. Benefits Include greater flexibility in turbine siting and increased stability in marine deposits. A deep foundation support system requires a greater level of detail in design and is relatively costly to construct when compared to a typical spread footing. Specialized geotechnical and structural design expertise as well as contractors that have experience with similar foundations are required.

Consultation with the wind turbine manufacturer is strongly recommended to determine suggested foundation types once a final site is selected; most wind turbine manufacturers require some type of review or approval of any proposed foundation. The electrical grounding system is typically integrated into wind turbine foundations, and must meet manufacturer and applicable code requirements. Wind turbine foundations must be properly designed and include localized geotechnical data, and structural designs using proper wind loading and tower specification assumptions.

PERMITTING AND REGULATORY ASSESSMENT

Section 6

SED has investigated the various permitting requirements that would be applicable for a wind turbine installation at the University of Delaware-Lewes campus. This evaluation was compiled from an analysis of applicable federal, state and local regulations, discussions with officials, prior permitting experience and industry best practices. The following contains a clearly defined pathway for successfully permitting this wind energy project. SED has prepared permitting tables to identify state and federal requirements with a description provided for the most applicable regulations.

6.1 FEDERAL REGULATIONS

Federal Aviation Administration (FAA) - The project team will have to file a '*Notice of Proposed Construction or Alteration* '(Form 7460-1) for a maximum turbine height above ground level and above mean sea level (amsl), which is recommended as soon as a project moves into the design phase. This notice is required for both crane erection during the construction phase and the wind turbine itself. All structures above 60.66m (199 ft.) in height require this filing or if the object is closer than 20,000 ft (6,096 meters) to a public-use airport with a runway more than 3,200 feet (975m) long. All structures above 60.66m (199 ft) in height must be lit according to FAA determinations.

The wind turbine being considered for UD-Lewes would surpass this height threshold and require approval from the FAA with any associated conditions. If a "Determination of No Hazard' is given, the FAA will outline these conditions, likely to be a filing 10 days prior to construction and lighting requirements. For assessing the likelihood of approval, SED has included a table listing all nearby public and private (Figure 6-1*).* The closest public airport is the Sussex County Airport (GED), which at 12.4 miles away will likely not pose any issues for FAA approval of this wind turbine. Consideration was also given to the Dover Air Force Base, but based on the distance to the facility and flight patterns to the facility, which should have no bearing on the proposed wind turbine.

Figure 6-1 Airports Near University of Delaware – Lewes Campus

Location	Symbol	Type	Distance/Direction from Turbine
Eagle Crest Hudson Airport	DE25	Private	~3.8 miles W
Barcroft Co. Heliport	DE08	Private	~3 miles E
Rehoboth Bay Seaplane Base	DE13	Private	~8 miles SSE
Ockl Farms Airport	DE23	Private	~11 miles WSW
Joseph's	DE49	Private	~14.5 miles SW
Sussex County Airport	GED	Public	~12.4 miles SW
Dover AFB	DOV	Military	~28 miles NW

Additionally, SED performed a circle search from the nearest large airport, Sussex County (GED), of existing tall structures to gain a sense of other obstructions that already exist and have been approved by the FAA. SED identified several locations that were at, or exceeded the overall structure height of the proposed turbine at UD-Lewes. Most notable of these can be seen on the Aeronautical Chart below (Figure 6-2), just to the West of Milton ( ), that is an antenna with a height of 451 feet agl. SED feels confident, that based on the analysis of nearby airports, other tall structures and general review of flight patterns in the area that a wind turbine at UD-Lewes will receive a 'Determination of No Hazard,' but will require notification and lighting.

Figure 6-2 Aeronautical Chart of University of Delaware – Lewes Area.

Federal Communications Commission (FCC) - The process of determination for filing to the FCC is initiated by the filing with the FAA. To mitigate concerns of FCC enforcement potential due to interference, large wind farm developers typically commission engineering studies to determine the extent of any impacts to surrounding FCC licensed facilities. The lead agency could require the performance of this type of study if deemed appropriate. However, single wind turbines are not likely to interfere with any FCC licensed facilities, as this problem is usually limited to large numbers of wind turbines that interrupt significant portions of airspace.

U.S. Fish & Wildlife Service (USFWS) - Due to the potential wind turbine's close proximity to the Prime Hook National Wildlife Refuge (approximately 5.2 miles) and location near federally identified wetlands, it is recommended the project team coordinate with the USFWS local field office[3] and local conservation groups to assess any effects a wind turbine installation would have on these sensitive habitats if the project moves into the design phase. As this is a single wind turbine installation, SED does not anticipate any major issues that would impact the development of this project.

Avian and Wildlife Considerations

The prospective location for a wind turbine at UD is near sensitive habitat areas including the Prime Hook Wildlife Refuge, the Great Marsh Preserve and the Atlantic Flyway.

> **Prime Hook National Wildlife Refuge (PHNWR) -** In 1963, Prime Hook National Wildlife Refuge was established under the authority of the Migratory Bird Conservation Act for use as an inviolate sanctuary for migratory birds. The Refuge covers roughly 10,000 acres and is a major stop-over point for migrating avian species. Due to distance from actual turbine location, this will likely not pose any issues to the development, but is detailed here to stress the sensitivity of the area and need for avian investigation. Sensitive species are also present in the area including the Delmarva fox squirrel, nesting bald eagles and migrating peregrine falcons.
>
> **Great Marsh Preserve –** The Nature Conservancy administers this 17,000-acre coastal wetland near the mouth of the Delaware Bay. It covers much of the area between UD-Lewes campus and Prime Hook National Wildlife refuge. There is no regulating authority attached to this area, but outreach steps should be made to the Nature Conservancy, as well as other conservation groups regarding this development.
>
> **Atlantic Flyway** - The Atlantic Flyway is a major avian migration route that follows the Atlantic coastline and the PHNWR is a major stop-over point for migrating species. It's presence near the

[3] USFWS New Jersey Field Office – Pleasantville, NJ.

UD-Lewes campus signifies the need for an avian investigation in the next phase of this development.

Due to these environmental sensitivities, SED recommends that the project team commission studies to better understand how a wind turbine at UD-Lewes would interact with the local habitat and wildlife. SED must stress though that the impacts a single wind turbine would have are minimal due to the very limited area that would be impacted. SED has worked with local conservation and avian groups on similar projects and have received positive feedback. The State of Delaware currently has no particular siting laws for wind turbines and wildlife impacts. Many states with siting laws still make an exception for projects of limited size, such as the one being considered at UD-Lewes.

In conversations with USFWS Wildlife Biologist A. Hoar[4] regarding this project, it was recommended that if this project moves into the design phase, that the project team coordinate with the USFWS field office in New Jersey on whatever environmental resource work should be done. The particular sensitivity of bat populations, especially in light of White Nose Syndrome, has made the USFWS particularly aware of the species and effects on them. Therefore, a bat study was recommended. The recommended avian study, according to Mr. Hoar, should include investigation into temporal and spatial use of airspace. Additional focus should be on the area as a stop-over point for avian migration from Cape May particularly in the fall and spring. It was also recommended that some post-construction mortality work be done to better understand a single wind turbine's impact. This would provide an excellent opportunity to involve the UD-Lewes community in the projects and provide valuable data for research into wind turbine avian/bat impacts.

Federal Wetlands ~ U.S. Army Corps of Engineers and Environmental Protection Agency[5] Under Section 404 of the Clean Water Act (CWA), the Army Corps of Engineers (Corps) has authority to regulate certain activities within waters of the United States, including wetlands, as designated by the Environmental Protection Agency (EPA). The National Wetlands Inventory (NWI) is a database of federally designated wetlands that provides guidance to permitting authorities on where these sensitive habitats exist. Section 404 of the CWA defines a wetland as:

"*Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically*

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[4] Telephone conversation with A. Hoar, Wildlife Biologist, USFWS performed by Matthew Vanderbrook, SED. 4/10/2009.

[5] Many of the details relating to this filing were drawn from the U.S. Army Corps of Engineers Document, "Are You Planning Work in a Waterway or Wetland?"

adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

In a review of the NWI database as it relates to the anticipated turbine locations (Figure 6-3*)*, the turbine site and access road are located within a federally designated wetland for Location 2. The access road for Location 1does cross an emergent wetland, but as this road is already in use and affects a limited area, this should not be a concern. Location 1 is designated with the inventory code of E2SS1, which identifies the habitat that exists at the location[6]. This designation would potentially trigger the need for a 'Permit for Discharge of Dredge or Fill Material' from the U.S. Army Corps of Engineers. In conversations with E. Maurmeyer, an Environmental Consultant at CER, Inc., Ms. Maurmeyer stated that wetland delineation would be necessary at Location 2 if it is the chosen as the designated turbine location[7]. This study would delineate the wetlands within the project area, which would then need to be passed along to the Corps regulatory branch in Philadelphia.

Figure 6-3 NWI Wetlands Map

Permit for Discharge of Dredge or Fill Material - Section 404 of the CWA authorizes the Corps to regulate the discharge of dredged or fill material into waters of the United States. This will be the regulatory requirement required if Location 2 is located on wetlands according to a wetland delineation

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[6] E being Estuarine, (2) being intertidal; (SS) being Scrub-Shrub and (1) being Broad-Leaved deciduous.
[7] Telephone conversation with E. Maurmeyer, Environmental Consultant, CNS, CER, Inc. performed by Matthew Vanderbrook, SED. 4/14/2009.

study and the construction area were to exceed 4,356 sq. ft. The wetland delineation report will be submitted along with a 'Preliminary Jurisdictional Form' (Preliminary JD). From this, the Corps will determine whether they have jurisdiction over the area and the project team will need to file for a permit.

There are two categories of permits that a project at UD-Lewes could receive: an *Individual Permit* or *General Permit*.

> **General permit** – applies to activities the Corps has determined are substantially similar in nature and cause environmental impacts, both individually and cumulatively. These require notification before activity can begin. Two types of permits
>
> > *Nationwide Permit* – For certain minor projects, including minor road crossings. Have special conditions that need be met for project to qualify and may require notification to Corps prior to commencement of work.
> >
> > *Regional Permit* – apply to certain minor activities authorized by the Corps on a regional or statewide basis.
>
> **Individual Permit** – required if project does not fall under critera for general permits. These permits are individually reviewed by the Corps.

In discussions with Corps Engineer, L. Slavitter[8], it was stated that the project team should make all effort to avoid or minimize project area that would occur in wetlands. If a limited area is disturbed (less than 1 acre), potentially the crossing of the access road, then a nationwide permit would be applied and only require notification to the Corps. This total process could take 45 days. If the project area exceeds this, then an individual permit would be needed. The time frame for this process is not defined and would pose significant delays to the project proceeding. It would open up the process to public comments, hearings and potentially involve assessment of secondary impacts.

If it was determined that the project area at potential turbine location 2 would require an individual permit, SED would therefore recommend potential turbine location 1 or an alternate site be considered for the installation of a wind turbine. The timeline associated with this permit and opening of public comment, could pose significant hurdles to this development that could be avoided at a different location. As stated by L. Slavitter regarding the need for an individual permit, "all bets are off."

[8] Telephone conversation with L. Slavitter, Engineer, US Army Corps of Engineers performed by Matthew Vanderbrook, SED. 4/12/2009.

Figure 6-4. Applicable Federal Regulations[1]

Regulation/Permit	**Authority**	**Citation**	**Approval Time**	**Comments**
Notice of Proposed Construction or Alteration, 7640-1 "Part 77" review	Federal Aviation Administration (FAA)	14 CFR Part 77	Will need to file Notice of Proposed Construction (3-4 months)	Required for crane erection and tower structure. All structures above 199 ft will need lighting
Service Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines	Fish & Wildlife Service	May 13, 2003 http://www.fws.gov/r9dhcbfa/wind.pdf	Guidance Only	Avian Impact Assessment is recommended
Habitat Conservation & Incidental Take Permit	Fish & Wildlife Service	Endangered Species Act		Will be initiated during design
Migratory Bird Treaty Act	Fish & Wildlife Service	Migratory Bird Treaty Act	Prohibits the taking, killing possession etc. of migratory birds	Enforcement potential
Golden Eagle Protection Act	Fish & Wildlife Service	Golden Eagle Protection Act		Enforcement potential
Permit for Discharge of Dredge or Fill Material	U.S. Army Corps of Engineers	Section 404 of the Clean Water Act	6 to 24 months	Enforcement Potential
Federal Consistency	NOAA's Office of Ocean and Coastal Resource Management (OCRM)	Coastal Zone Management Act (CZMA) in 1972	180 Days	Filed concurrently with Delaware Coastal Zone Management Program

6.2 STATE REGULATIONS

Delaware Department of Transportation (DDOT) - Transportation concerns that need to be addressed include the ability to safely transport the wind turbine components to the construction site and to stage these components with adequate space for installation. The subcontracted transport company will obtain all necessary permits and approvals for transport of components from the port of delivery to the UD-Lewes site. These include State and local approvals for transport including bridge, overpass and utility line thresholds/clearances.

Due to the unique nature of wind turbine blade, nacelle, and tower transport, special attention needs to be paid to the shipping route in regards to tight curves and steep grades. The maximum weights and measures for the components of the GE SLE Figure 4-1 should be used in all transport determinations.

Based on a review of the State of Delaware Department of Transportation's (DDOT) regulation on the 'Size and Weight of Vehicle Loads' A permit shall be required for movement on the highways of the State of Delaware when any "vehicle, vehicle combination, vehicle and load combination, and/or equipment or machinery being moved under its own power exceeds the dimensional and/or weight limits" as set forth in Chapter 45, Title 21 of the Delaware Code. The transportation figures for the wind turbine considered for this project, the GE SLE-77 1.5MW, is shown in Figure 6-5. Due to the transportation figures and limits from the DDOT, the transport of the wind turbine, as well as crane components will require a Hauling Permit for oversize/overweight loads. This process will also entail some fees for transporting wind turbine and crane components.

Figure 6-5. Transport Specifications of the GE 1.5 MW SLE Wind Turbine*

Maximum height of load:	4.5 meters (14.75 feet)
Maximum weight of load:	42 tonnes (92,500 lbs.)
Maximum length of load:	37.5 meters (123 feet)
Maximum width of load:	4.5 meters (14.75 feet)

*Weights and measures do not account for trailer and transport equipment.

Delaware Natural Resources and Environmental Control (DNREC) – The DNREC Office conducts environmental impact reviews of certain projects requiring state agency action. Agency actions include granting State permits or licenses, providing state financial assistance, or transferring state land. Based on the proposed turbine locations for this project, SED expects this project to require environmental review by the DNREC. In order for this project to move forward, SED expects the following permits to be required:

Sediment and Stormwater Program, Division of Soil and Water Conservation – The program employs a comprehensive approach to sediment control (both during and after construction) and stormwater management that includes monitoring of stormwater quantity and water quality control. Based on assessment of the wind turbine location, it will be necessary for the project to get a Notice of Intent (NOI) for Stormwater Discharges Associated with Construction Activity. The project team must put together a detailed sediment and stormwater plan that is to be approved by DNREC[9]. The plan must address permanent peak stormwater discharge control, as well as stormwater quality management. A waiver may be eligible if a non-erosive conveyance of stormwater runoff to tidal water can be provided. The target pollutants for this development would be sediment and nutrients. This permit may not be necessary as it would only apply to "land disturbing activity" that would exceed 5000 sq. ft.

Coastal Management Program, Division of Soil and Water Conservation - As provided for by the Federal Coastal Zone Management Act of 1972, any project requiring federal license or permit must be consistent with policies of the Delaware Coastal Management Program (DCMP). Projects are reviewed by DCMP staff in close coordination with other agencies. If projects are consistent with the policies, Federal Consistency "concurrence" is issued. This would only be necessary if a federal permit is required for this project or if a Wetlands Permit is required from the State of Delaware.

Wetlands and Subaqueous Lands, Division of Water Resources – If the project area exists within a wetland as defined by the State of Delaware (Figure 6-6*)*, a Wetland Permit will be required. J. Chaconas of DNREC, in a preliminary review of the project site, stated that "the access road for the project would [appear to]cross wetlands," at Location 1, but "that doesn't necessarily mean that it does [cross wetlands]."[10] A site visit will be required by DNREC, if the project moves to the next phase to determine this. If the road does infringe on wetlands, the following permits may be required:

> **Subaqueous Permit** – this permit is required for work done in submerged lands[11] or tidelands.[12] Based on these definitions and a review of the both proposed turbine locations, this permit should not apply to this project.
>
> **Wetlands Permit**—this authorization is required for any activity taking place in State-regulated wetlands in the State of Delaware. For proposed turbine location 1, a Type I Permit (Abbreviated Procedure) may be required because the amount of work done on wetland would potentially

[9] According to the DNREC, this program is delegated to the Sussex County Conservation District. But as UD is a state entity, it is likely that DNREC will be the authority.

[10] E-mail correspondence on 4/13/2009 with Matthew Vanderbrook, SED.

[11] Lands lying below the line of mean low tide in the beds of all tidal waters within the boundaries of the State, together with the beds of navigable rivers, streams, lakes, bays, inlets, ponds, or other waterways within the boundaries of the State (*Title 7; 7504 Regulations Governing the Use of Subaqueous Lands; Definitions).*

[12] Lands lying between the line of mean high water and the line of mean low water (*Title 7; 7504 Regulations Governing the Use of Subaqueous Lands; Definitions).*

disturb 1 acre. Based on a review of the State of Delaware Wetlands Maps, it appears that turbine staging area would not infringe on the wetland. It is possible that the access road would, but it would likely be less than 1 acre and would not require approval. The area where both proposed locations exist is classified as O, or an upland resource. It was recommended that, once a final turbine location is selected, that DNREC officials perform a site visit to delineate the wetlands.

Figure 6-6 – State of Delaware Wetlands Delineation Map

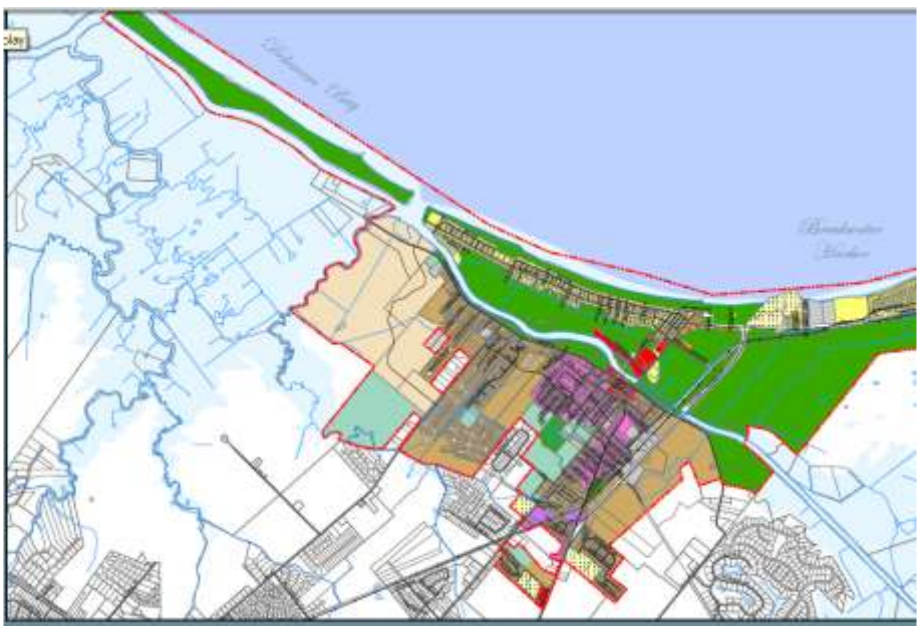
Fig 6-7 Applicable State Regulations

Regulation/Permit	Authority	Citation	Approval Time	Comments
Notice of Intent (NOI) for Stormwater Discharges Associated with Construction Activity	Delaware Coastal Zone Management Program	The Regulations Governing Storm Water Discharges Associated with Industrial Activities (Section 9, Subsection 1, Part 1)		Required if work area exceeds 5,000 sq. ft.
Coastal Construction Permit	DNREC – Division of Soil and Water; Shoreline and Waterway Management Section	Beach Preservation Act (Chapter 68, Title 7 of the Delaware Code	50 Days	For sites within 1000 feet of Atlantic Ocean and Delaware Bay
Wetlands Permit	DNREC – Division of Water Resources	Delaware Wetlands Act	120 Days	Will be initiated during design
Consistency Certification	Division of Soil and Water Conservation	Coastal Zone Management Act (CZMA) in 1972	180 Days	Oversight of federal application under CZMA
Hauling Permit	Delaware Department of Transportation	Chapter 45, Title 21 of the Delaware Code	Three day window for transport	Fees required

6.3 LOCAL PERMITTING

In addition to state and federal permitting the wind turbine would have to satisfy local approvals/permitting before construction can begin. The City of Lewes does not have an ordinance relating to the installation of wind turbines, although in conversations with the City Building Commissioner, H. Baynum, it was suggested that this may be something the City considers investigating further.[13] The project team should follow up with the City on working to draft an appropriate wind turbine ordinance, if the project proceeds to design. It was also suggested that the most likely pathway for permitting approval for this type of project would be to obtain a variance for exceeding the current height limit of 35 feet. This process would require filing with the Lewes Board of Adjustments for a variance, that if and when given, a building permit application could be submitted. According to the City of Lewes Zoning Map (Figure 6-8) the area where the turbine is to be installed is zoned as University/Institutional, where the height limit is 35 feet .

Figure 6-8 City of Lewes Zoning Map



Historical - The City of Lewes is considered to be a historic site, as it was the first incorporated city in the state. In light of this historical sensitivity, SED recommends working with the Lewes Historical Preservation Commission (HPC) to provide information and discuss the merits of this project. Based on a reading of the HPC guidelines it is evident that this wind turbine would not be subject to these provisions,

[13] Telephone conversation with H. Baynum, Building Commissioner, City of Lewes by Matthew Vanderbrook, SED. 4/06/2009.

since it is not located in the Historic District and is not a residence. HPC Commission Member D. Seliksar further supported this position, stated that this project would not be under the jurisdiction of the HPC.[14]

Public Outreach - All pertinent information relating to the project should be presented to the public and abutters at community meetings or open houses hosted by the University. In these settings, details of the project should be presented and concerns that community members may have should be addressed appropriately. Public transparency is a key to successful wind energy project development and the efficient receipt of public approvals and community acceptance. All project team members and appropriate University officials should have or be provided with a working understanding of the basic issues associated with wind energy projects such as noise, ice throw and visual impact at they apply to this project.

Figure 6-9. City of Lewes Permits and Approvals

Permit/Approval	Authority	Comments
Use Variance	Lewes Board of Adjustments	Required for all structures exceeding 35 feet in height
Historical Preservation Commission Approval	Lewes Historical Preservation Commission	Although location not located in Historic District, could be required due to visual impact of wind turbine
Building Permit	Building Inspector	Apply after zoning variance is approved

6.5 VISUAL ASSESSMENT

One part of a wind project, which cannot easily be quantified, is the aesthetics and how people within sight of the project will perceive the wind turbine. Most wind turbines reach a significant height in the air and have potential to be visible from the surrounding area. For this reason it is important to create an accurate photo simulation or photomontage in order to assess the visual impacts of the project. This picture will provide a useful tool to the public for approvals, although photos from additional angles or a balloon float may be necessary during the design phase. The height and blade diameter for a 1500kW wind turbine was used for sizing.

One of the largest considerations for choosing a site to take the pictures for the UD-Lewes visual assessment was the ground cover, environmentally sensitive areas and location relative to the campus. The region surrounding the UD-Lewes site is covered with small trees and shrubs (5 to 10 meters in height) and wetland or marsh areas. The potential turbine location is highly visible due to its elevation relative to the

[14] E-mail correspondence on 4/08/09 with Matthew Vanderbrook, SED.

surrounding area. Visibility of the potential location is important because it provides the best and most accurate frame of reference for sizing the wind turbine on the picture

Figure 6-10. Visual Assessment Details

Site	Distance to Turbine Location	Direction Facing	Site Coordinates (UTM/WGS84)
Pilottown Road	590m (1939 ft)	SSE	485609.3 E, 4293391.8 N

Figure 6-11. Picture Location, Turbine and Line of Sight

Figure 6-12. Visual Photomontage of Wind Turbine at Location 1

6.5 RECOMMENDATIONS

There do not appear to be any fatal flaws that would limit the permitting of this project on the local, state or federal level. The biggest concern is associated with potential turbine location 2 and the potential need for a permit from the US Army Corps of Engineers relating to development in a wetland. If this site is selected and it is determined to require an individual permit this could introduce significant development hurdles and cause serious timeline disruption. SED's experience suggests that the best policy to move swiftly and efficiently through the permitting process takes the form of thorough preparation followed by engaging the public.

The first stage of the process will be the performance of environmental studies necessary for the site conditions at the UD-Lewes site including but not limited to avian, rare and endangered species studies.

Due to the proximity of the wind turbine location to the Prime Hook National Wildlife Refuge and presence of the Atlantic Flyway, SED recommends that an Avian & Wildlife Study be commissioned to investigate the species in this area and what potential impact, if any, a wind turbine would have on these species and their habitat. Also, depending upon the selected site, the project team should commission wetland delineation study to determine if the project area is within designated wetlands and trigger oversight by the Corps or DNREC. All pertinent team members should have or be provided with a working understanding of the basic wind energy issues like noise, ice, and visual impact as they apply to the development.

The second step of the process is to officially file for the necessary local permitting for the construction of the project. By making this official entrance into the local permitting process the project should avoid the delays of a moratorium or other delaying tactics. The project team should also work with the City of Lewes to develop an appropriate wind turbine ordinance.

Once the permits have been filed, the project team should engage the community at the earliest possible date and include them in the development process wherever possible. The project team should meet with local people of influence, environmental groups and potential wind energy opponents in order to seek their support for the project. By establishing a two-way dialogue with the public, the project team should be able to avoid costly delays and/or the creation of well-organized resistance. The goal of all of these meetings should be to avoid heated debate in the public forum. SED further recommends that the project team engage the HPC and local conservation groups to provide information on the development and work with them to alleviate potential concerns.

DEVELOPMENT BUDGET, TOTAL CAPITAL COSTS, OPERATIONS AND MAINTENANCE AND TIMELINE

Section 7

The capital cost estimates provided in this report are indicative of SED performing this work and likely do not reflect the cost that a less experienced firm may charge for similar services.

7.1 DESIGN BUDGET

The following Design Budget (Figure 7-1) provides conservative estimates of the pre-construction costs for a 1.5 MW wind project at UD-Lewes based upon the findings of this report and SED's experience with similar projects. These projections should be updated on a continual basis as work commences.

Figure 7-1 Design Budget

University of Delaware- Lewes Design Tasks	***1500 kW***
1.0 Project Milestones	
1.1 Project Progress Briefing	$1,540
1.2 Final Report	$2,370
2.0 Permitting Toolbox	
2.1 Avian and Wildlife Impact Assessment	$12,595
2.2 Noise Impact Assessment	$8,755
3.0 Public Outreach	
3.1 Public Forums and Hearings	$7,100
4.0 Permits and Regulatory Filings	
4.1 Building Permit Filed	$6,885
4.2 Local Zoning Variance	$3,915
4.3 DNREC Filings	$3,345
4.4 DDOT Hauling Permit	$1,025
4.5 U.S. Army Corps of Engineers - Section 404 Regional Permit	$3,865
4.6 FAA Filed	$830
5.0 Interconnection Application	$10,000
6.0 Project Design	
6.1 Civil Design	$54,400
6.2 Communication Design	$3,390
6.3 Electrical Design	$41,100
6.4 Select and Hire Electrical and Civil Contractors	$4,500
7.0 Capital Cost Estimates	
7.1 Wind Turbine Inquiry	$5,500

7.1.1 Finalize Wind Turbine Purchase Agreement	$4,100
7.2 Capital Cost Estimates	$7,050
8.0 Green Marketing	$5,900
9.0 Project Financing	
9.1 Finalize Project Financing	$12,300
10. 0 Operations and Maintenance Planning	$2,780
11.0 Project Management	$12,900
12.0 Travel Costs (5 Total Trips)	$9,670
Total Design	**$235,485**

7.2 TOTAL CAPITAL COST

The capital costs and life cycle costs for a wind energy generating facility have been compiled based on best practices and SED's experience with similar sized projects. Figure 7-2 breaks the capital costs for this project into three main categories and shows the "all-in" cost for a project located at the UD-Lewes. An additional buffer was added to the electrical costs as shown in Section 3 of this report to provide an overly conservative cost ceiling.

Figure 7-2 Total Capital Cost Estimates

	GE 1.5MW	**GE 1.5MW**
Wind Turbine Equipment	**Site 1**	**Site 2**
Turbine and Blades	$2,250,000	$2,250,000
Customs Duty (US 3.5%)	$0	$0
Turbine and Blade Freight	$125,000	$125,000
Tower and Foundation Insert	Included	Included
Tower Freight	$125,000	$125,000
Miscellaneous Options/SCADA/FAA/Corrosion Protection	$100,000	$100,000
Sub Total	**$2,600,000**	**$2,600,000**
Civil Construction		
Access Road	$25,000	$100,000
Site Clearing	$25,000	$75,000
Bolt Assembly	$75,000	$75,000
Crane Pad	$15,000	$30,000

Trenching	$25,000	$50,000
Grounding	$15,000	$15,000
Foundation Excavation	$25,000	$25,000
Pilings	$200,000	$200,000
Foundation Installation	$178,125	$178,125
Sub Total	**$583,125**	**$748,125**
Electrical Installation		
Wire Run	$150,000	$200,000
Interconnection Transformer	$75,000	$75,000
Final Electrical Terminations, Metering	$150,000	$150,000
Down Tower Wiring	$25,000	$25,000
Sub Total	**$400,000**	**$450,000**
Mechanical Installation		
Crane Set Up and Transport	$80,000	$80,000
Crane - Main (450 ton)	$140,000	$140,000
Crane - Tailing (100 ton)	$35,000	$35,000
Mechanical Labor	$60,000	$60,000
Rigging	$30,000	$30,000
Tensioning and Other Equipment	$15,000	$15,000
Sub Total	**$360,000**	**$360,000**
Commissioning/Site Engineering		
Civil	$15,000	$15,000
Mechanical	$15,000	$15,000
Electrical	$15,000	$15,000
Sub Total	**$45,000**	**$45,000**
Other		
Development/Design	$232,705	$232,705
Contingency	$139,584	$147,109
Project /Construction Management Labor	$190,964	$218,779
Sub Total	**$563,253**	**$598,594**
Total Capital Costs	**$4,554,158**	**$4,804,499**

7.3 OPERATION AND MAINTENANCE (O&M) COSTS

Equipped with sophisticated sensors, control systems, and protective equipment modern wind turbines are designed to operate automatically with little need for human intervention. Wind turbines are remotely monitored and can be controlled by various entities such as the owner, the manufacturer, and/or third-party operators.

Regularly scheduled maintenance is necessary and includes tasks such as oil changes, lubrication, torque checks, and visual inspections. These maintenance activities typically occur at six month intervals, and require different tasks based on the particular wind turbine and associated components. Unscheduled maintenance events may take place as well, and require on-site personnel to address issues. Typically, large wind turbine components are covered by the manufacturer-provided warranties in the event of a failure. These components, such as gearboxes, generators, and blades, experience large, variable loads and may require replacement outside of the provided warranty period. The probability of these failures can be accounted for based on the operating history of the wind turbine, reputation of the original parts manufacturers, and wind resource characteristics. A proactive and comprehensive O&M plan requires the consideration of all of these factors, and will minimize life-cycle costs and maximize wind turbine availability.

The combination of scheduled, unscheduled, and major replacement tasks are major factors that relate to "downtime" and "availability" of a wind turbine. Downtime is defined as the percentage of time the wind turbine is inoperable due to maintenance or faults. Conversely, availability is defined as the amount of time the turbine is able to operate. For this analysis, downtime was estimated at 2%, which translates to roughly 175 hours per year. This downtime is considered for O&M planning purposes and used in the annual energy output estimates of the wind turbine.

A total life-cycle O&M cost was estimated assuming a wind turbine life of twenty years, continuous monitoring, scheduled maintenance costs, unscheduled maintenance costs, and probable part failure costs. The projected capital costs related to annual O&M at UD-Lewes incorporate conservative estimations of these critical aspects. This total cost was normalized assuming a 3% inflation rate and annualized.

Wind turbine operations and maintenance figures for the UD-Lewes wind project can be broken down into four categories:

1. Warranty Service – During the warranty period, which is typically two years, the wind turbine owner is expected to pay for standard six month service costs, but not for unscheduled maintenance that will be covered under the warranty agreement.
2. Steady State O&M Service - SED assigned a budgetary figure of $0.012 per kilo-watt-hour of electricity produced by the 1.5MW wind turbine. This budgeting for maintenance will allow the

project to adequately account for routine and scheduled maintenance activities. This figure begins in Year 3, after the effective warrantee period, and will escalate at 3% annually.

3. Maintenance Reserve – SED recommends that a maintenance reserve be set aside on an annual basis to prepare for the possibility of a major component failure during the life of the wind turbine. It is up to the owner to determine a mechanism to store these funds, however, like any piece of mechanical equipment a wind turbine may have component failures after the warranty period and the owner should appropriately budget for these potential costs.
4. Insurance – Standard wind turbine insurance costs approximately $10,000 per Megawatt of generating capacity annually. Insurance provides coverage for general liability including act of god insurance for coverage of lightning and other weather related events. This cost will escalate at 3% annually.

These projected annual costs may be allocated to different entities based on the project ownership and warranty terms, but are nonetheless conservative and inclusive of all necessary tasks. Figure 7-3 is a summary of operations and maintenance costs for UD-Lewes wind turbine options.

Figure 7-3. Operations and Maintenance Costs for 1.5MW at UD-Lewes

	GE SLE 1.5MW
Yearly O & M Under Warranty	$20,000
Year 3 Steady State O & M	$48,285
Yearly Maintenance Reserve	$25,000
Year 1 Insurance Cost	$15,000

7.4 PROJECT TIMELINE

SED is recommending a timeline for development starting on June 15, 2009 allowing adequate time for review by UD officials and any procurement processes the project would require. Figure 7-4 highlights the anticipated timeline for this project using SED's past experiences with similar projects. Much like the costs presented in this report, this timeline is indicative of SED managing the development of this project and likely would not be representative of a less experienced firms capabilities.

The timeline presented below is broken out into the various tasks for each stage of development. The design phase consists of permitting and public outreach, turbine procurement, design engineering, interconnection and project financing. The longest lead time items are obtaining permit approvals, most notably permits required under the Clean Water Act due to the time required to gather all required information and . Public outreach will also commence early on in this stage and continue throughout the remainder of the project, in some form or another.

The construction timeline is wholly dependent upon the completion of design tasks and the time frame needed to procure and deliver the selected wind turbine. SED utilized experience from procuring the GE 1.5MW for determining this timeline, but this will be dependent upon the selected technology. The foundation, staging area and electrical infrastructure will be completed upon delivery of the wind turbine and erection will take place over a couple of weeks.

University of Delaware-Lewes Wind Energy Project (GE SLE 1.5MW)

Design Tasks	Mnth 1	Mnth 2	Mnth 3	Mnth 4	Mnth 5	Mnth 6	Mnth 7	Mnth 8	Mnth 9	Mnth 10	Mnth 11	Mnth 12	Mnth 13	Mnth 14	Mnth 15	Mnth 16	Mnth 17	Mnth 18	Mnth 19	Mnth 20
1.0 Project Milestones																				
1.1 Project Progress Briefing																				
1.2 Final Report																				
2.0 Permitting Toolbox																				
2.1 Avian and Wildlife Impact Assessment																				
2.2 Noise Impact Assessment																				
3.0 Public Outreach																				
3.1 Public Forums and Hearings																				
4.0 Permits and Regulatory Filings																				
4.1 Building Permit Filed																				
4.2 Local Zoning Variance																				
4.3 DNREC Filings																				
4.4 DDOT Hauling Permit																				
4.5 U.S. Army Corps of Engineers - Section 404 Regional Permit																				
4.6 FAA Filed																				
5.0 Interconnection Application																				
6.0 Project Design																				
6.1 Civil Design																				
6.2 Communication Design																				
6.3 Electrical Design																				
6.4 Select and Hire Electrical and Civil Contractors																				
7.0 Capital Cost Estimates																				
7.1 Wind Turbine Inquiry																				
7.1.1 Finalize Wind Turbine Purchase Agreement																				
7.2 Capital Cost Estimates																				
8.0 Green Marketing																				
9.0 Project Financing																				
9.1 Finalize Project Financing																				
10.0 Operations and Management Planning																				
11.0 Project Management																				

Construction Tasks

Project Management	Mnth 1	Mnth 2	Mnth 3	Mnth 4	Mnth 5	Mnth 6	Mnth 7	Mnth 8	Mnth 9	Mnth 10	Mnth 11	Mnth 12	Mnth 13	Mnth 14	Mnth 15	Mnth 16	Mnth 17	Mnth 18	Mnth 19	Mnth 20
1.0 Construction Period 1: Wind Turbine and Tower*																				
1.1 Wind Turbine Manufacturing																				
1.2 Transport To Site																				
2.0 Construction Period 2: Foundation*																				
3.0 Construction Period 3: Electrical Infrastructure																				
4.0 Construction Period 4: Erection and Commisioning																				

ECONOMIC ANALYSIS

Section 8

The GE 1.5 MW wind turbine was used in these financial models with variables calculated in the prior sections and assumptions that will be explained below. The conclusions from the individual portions of this study were input into the cash flow analysis for the GE 1.5MW wind turbine. The results are listed below with consideration of energy escalation rates at 0%, 3%, 5% and 8%. A summary of the cash flow analysis for the wind turbine, wherein UD would own and pay for 100% of the project costs upfront (unleveraged), is provided by Figures 8-1 and 8-2.

Most of the factors used to determine the economic effects of a wind energy generating facility at the UD-Lewes have been detailed earlier in the report.

- Annual Energy Production (Figure 1-21)
- Wind Generated Electricity Value (Figure 3-16)
- Capital Costs (Figure 7-2)
- Operations and Maintenance Cost (Figure 7-3)
- Insurance Costs (Figure 7-3)

The final step of the economic analysis is to combine these findings to perform a cash flow analysis. In addition to the assumptions detailed elsewhere in this report the following assumptions will be applied to this cash flow analysis:

- UD-Lewes will pay cash down for 100% of the project cost.
- A appropriation of $1.4 million from the FY-2008 Budget is available to UD specifically for this project
- The maximum available from the Delaware Green Energy Fund's Technical Demonstration Project is $200,000.
- Operation, Maintenance and Insurance costs will increase with standard inflation of 3%.
- Renewable Energy Credits (RECs) are available for purchase from on-site wind energy projects in Delaware and UD will receive $0.02/kWh for a period of 20 years.

A summary of the three different economic scenarios for the wind turbine at proposed turbine location 1 and proposed turbine location 2 is shown in Figures 8-1 and 8-2 below with 3% energy escalation rate.

Figure 8-1 IRR, Paybacks and Savings at Proposed Turbine Location 1 at 3% Energy Escalation Rate

	IRR % (equity only)	Payback Term (Years)	20 Year Savings
Unlevered	8.16%	10	$5,427,950
Including Appropriation	13.23%	7	$6,827,950
Including Appropriation and Additional Grant	14.26%	7	$7,027,950

Figure 8-2 IRR, Paybacks and Savings at Proposed Turbine Location 2 at 3% Energy Escalation Rate

	IRR % (equity only)	Payback Term (Years)	20 Year Savings
Unlevered	7.21%	11	$4,942,069
Including Appropriation	11.73%	8	$6,342,069
Including Appropriation and Additional Grant	12.62%	8	$6,542,069

8.1 SENSITIVITY ANALYSIS

It is important to understand the sensitivity of these financial returns based on changes in certain variables. Figures 8-3 through 8-9 demonstrate a sensitivity analysis of the IRR, payback period and total lifetime savings for the GE SLE 1.5MW wind turbine related to energy escalation rates. Electricity rates can vary greatly from year to year, but have a general upward trajectory that is accounted for in these analyses. The output page of the cash flow model for these figures is attached as Appendix D.

Figure 8-3 IRR, Paybacks and Savings at Proposed Turbine Location 1 Unlevered

Energy Escalation Rate	IRR % (equity only)	Payback Term (Years)	20 Year Savings
0%	4.79%	12	$2,530,543
3%	8.16%	10	$5,427,950
5%	10.36%	9	$8,086,176
8%	13.62%	8	$13,635,939

Figure 8-4 IRR, Paybacks and Savings at Proposed Turbine Location 2 Unlevered

Energy Escalation Rate	IRR % (equity only)	Payback Term (Years)	20 Year Savings
0%	3.87%	14	$2,107,118
3%	7.21%	11	$4,942,069
5%	9.40%	10	$7,542,985
8%	12.64%	9	$12,973,097

Figure 8-5 IRR, Paybacks and Savings with Appropriation from Federal Budget at Proposed Turbine Location 1

Energy Escalation Rate	IRR % (equity only)	Payback Term (Years)	20 Year Savings
0%	9.73%	8.5	$3,930,533
3%	13.23%	7	$6,827,950
5%	15.52%	7	$9,486,176
8%	18.92%	6	$15,035,939

Figure 8-6 IRR, Paybacks and Savings with Appropriation from Federal Budget at Proposed Location 2

Energy Escalation Rate	IRR % (equity only)	Payback Term (Years)	20 Year Savings
0%	8.26%	9	$3,507,118
3%	11.73%	8	$6,342,069
5%	14.00%	7.5	$8,942,985
8%	17.36%	7	$14,373,087

Figure 8-7 IRR, Paybacks and Savings with Appropriation from Federal Budget and State Grant at Proposed Location 1

Energy Escalation Rate	IRR % (equity only)	Payback Term (Years)	20 Year Savings
0%	10.74%	8	$4,130,533
3%	14.26%	7	$7,027,950
5%	16.57%	6.5	$9,686,177
8%	20.00%	6	$15,235,939

Figure 8-8 IRR, Paybacks and Savings with Appropriation from Federal Budget and State Grant at Proposed Location 2

Energy Escalation Rate	IRR % (equity only)	Payback Term (Years)	20 Year Savings
0%	9.13%	9	$3,707,118
3%	12.62%	8	$6,542,069
5%	14.91%	7	$9,142,985
8%	18.30%	6.5	$14,573,097

Figures 8-9 and 8-10 demonstrate a sensitivity analysis of the IRR, payback period and total lifetime savings for the GE SLE 1.5MW wind turbine related to percent change in wind generated electricity value based on change in predicted AEP of the GE SLE 1.5MW wind turbine.

Figure 8-9 Sensitivity Analysis of the IRR, Payback Period and Total Lifetime Savings for Wind Turbine at Location 1 Related to Changes in AEP, with Appropriation.

Annual Energy Production (AEP) of Wind Turbine			
Percent Change	AEP (kWh)	IRR (%)	Payback Period (Years)
80%	3,219,000	9.67%	9.34
85%	3,420,188	10.59%	8.78
90%	3,621,375	11.49%	8.28
95%	3,822,563	12.37%	7.84
100%	4,023,750	13.23%	7.43
105%	4,224,938	14.07%	7.07

Figure 8-10 Sensitivity Analysis of the IRR, Payback Period and Total Lifetime Savings for Wind Turbine at Location 2 Related to Changes in AEP with Appropriation.

Annual Energy Production (AEP) of Wind Turbine			
Percent Change	AEP (kWh)	IRR (%)	Payback Period (Years)
80%	3,149,600	8.33%	10.22
85%	3,346,450	9.25%	9.61
90%	3,543,300	10.09%	9.08
95%	3,740,150	10.92%	8.59
100%	3,937,000	11.73%	8.15
105%	4,133,850	12.52%	7.77

The sensitivities associated with the turbine's AEP do not change the strong financial results that exist with this project, as was the case with changes in electricity rates.

8.2 NET METERING SCENARIO

Due to the many unknowns associated with how the sale of excess electricity from this project would be handled, SED performed the analysis assuming that the turbine would provide power directly to the Smith and Cannon buildings on the UD-Lewes campus. From conversations with University officials, SED has also included an economic analysis of the project where all excess electricity generated would be net metered at the facilities retail rate. The retail rate of electricity at UD-Lewes is $0.124/kWh.

Figure 8-11 IRR, Paybacks and Savings with Appropriation from Federal Budget at Proposed Turbine Location 1 with Net Metering

Energy Escalation Rate	IRR % (equity only)	Payback Term (Years)	20 Year Savings
0%	14.48%	6	$6,363,400
3%	18.06%	6	$10,193,544
5%	20.42%	5	$13,707,497
8%	23.93%	5	$21,043,820

Figure 8-12 IRR, Paybacks and Savings with Appropriation from Federal Budget at Proposed Turbine Location 2 with Net Metering

Energy Escalation Rate	IRR % (equity only)	Payback Term (Years)	20 Year Savings
0%	12.72%	7	$5,887,594
3%	16.26%	6	$9,635,162
5%	18.58%	6	$13,073,356
8%	22.05%	5	$20,251,551

FINANCING, OWNERSHIP, OPERATIONS
Section 9

For the purpose of this analysis SED is utilizing a GE SLE 1.5MW wind turbine at proposed turbine location 1, as it was demonstrated in Section 8 to be the most economically beneficial project. Therefore, this section will focus on the financing, ownership and operations for this particular wind turbine project. Each of the models used for this analysis has been adapted from the unlevered financing described in the previous section and the same assumptions apply. The baseline scenario for these analyses is an energy escalation rate of 3% and the inclusion of the appropriation from the Federal Budget for this project valued at $1.4 million.

9.1 THIRD PARTY OWNERSHIP

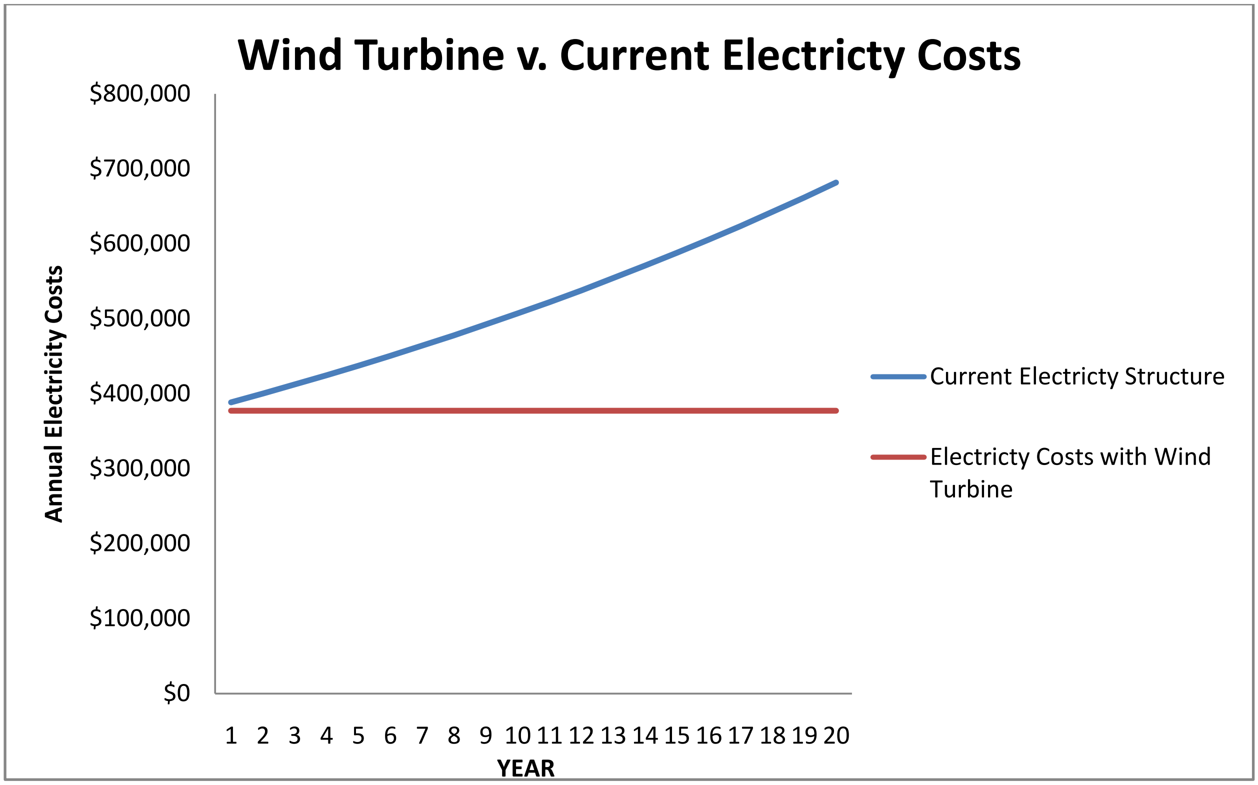
The third party ownership option would allow a private, third party to own and operate the wind turbine project and sell the power back to UD-Lewes at a predetermined long term power purchase contract. The advantage of this ownership model is that it would remove the associated risk from UD and still lock in the electric purchase pricing to hedge against an anticipated rise in electric rates. This hedge would also stabilize annual electricity expenditures over an extensive period of time, which would remove the cost uncertainty associated with energy expenditures, UD-Lewes budget expenses and therefore provide the campus with a more precisely designed budget.

SED has run a third party model for UD-Lewes and determined that a long term contract for electricity purchase would be attractive to the third party owner at an electric rate of $0.094/kWh. This is effectively the anticipated retail rate for power at UD-Lewes if 100% of the wind generated electricity could be used on-site, so the benefit would be zero capital investment on a wind turbine while still receiving the environmental and marketing benefits of a wind turbine and a hedge against future rise in electric rates. Figure 10-1 is a table showing the 20-year savings to UD-Lewes with a third party ownership scenario under differing utility 3% energy escalation and a flat PPA. Figure 10-2 is a graphical representation of that data.

Figure 9-1. Site Host Economic Benefits

Lifetime Savings (Years 1-20)	Year 1 Savings
$2,897,319	$11,332

Figure 9-2 Graph of Third Party Ownership Energy Savings



9.2 FLIP SWITCH MODEL

In this scenario, a third party owner takes the risk on the project from construction through the first ten years of operation. This allows a private entity to receive all of the tax benefits from the project, which are available during that period of the project's existence. At the end of the private ownership period, the project will be sold to UD-Lewes according to the IRS definition for "Market Value" as determined by a third party assessor. UD will then own and operate the project for the rest of the useful life of the wind turbine. For this analysis, a 3% rate of energy escalation and a year ten flip with a price equivalent to 20% of the original project cost or $630,272 were used. This scenario provides the UD with a relatively low risk and high reward scenario when compared to the other options.

Figure 9-3 Site Host Economic Benefits

IRR (Years 10-25)	Payback Period (Starting Year 10)	Pre-Flip Savings (Year 1 -10)	Lifetime Savings Year 1-25)
60.94%	1.35	$122,077	$3,586,405

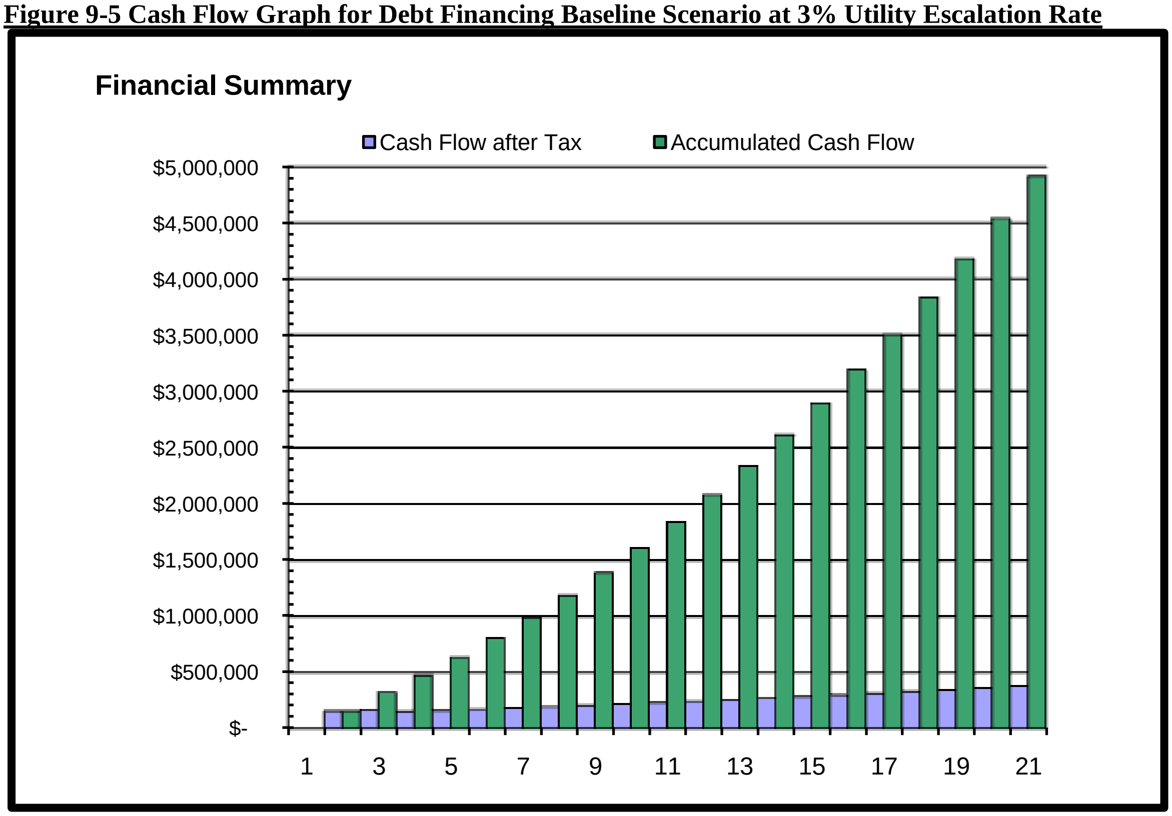
9.2 BOND FINANCING

In this scenario, UD-Lewes finances the project via a bank or other financial institution. The advantage of this structure is that by the spreading of debt payments over time UD can spread out the impact of the capital expenditure of the wind turbine over multiple years. The main advantage of this scenario over third party ownership is that although it involves more risk the long term benefits are far greater. For this analysis it is assumed that UD-Lewes pays 0% of the total project cost upfront and finances the remainder at 5% over 20 years via UD-Lewes normal bond holder. Figure 10-4 shows the results of this financing scenario.

Figure 9-4 Payback Term and 20 Year Saving for the GE 1.5MW Wind Turbine with Bond Financing

Year 1 Savings	Lifetime Savings
$156,141	$4,920,152

Figure 9-5 Cash Flow Graph for Debt Financing Baseline Scenario at 3% Utility Escalation Rate



It is important to note that in Figure 10-5 all calculations were made with a 20-year debt term and using the conservative wind generated electric value of $0.094/kWh calculated for the baseline scenario in Section 3 of this report. It is expected that the wind generated electric rate will be higher simply by increasing the on-site electric usage at UD-Lewes therefore significantly increasing the attractiveness of the debt financing cash flow. It is also important to note from Figure 10-5 the project actually makes money in the first few years of operation.

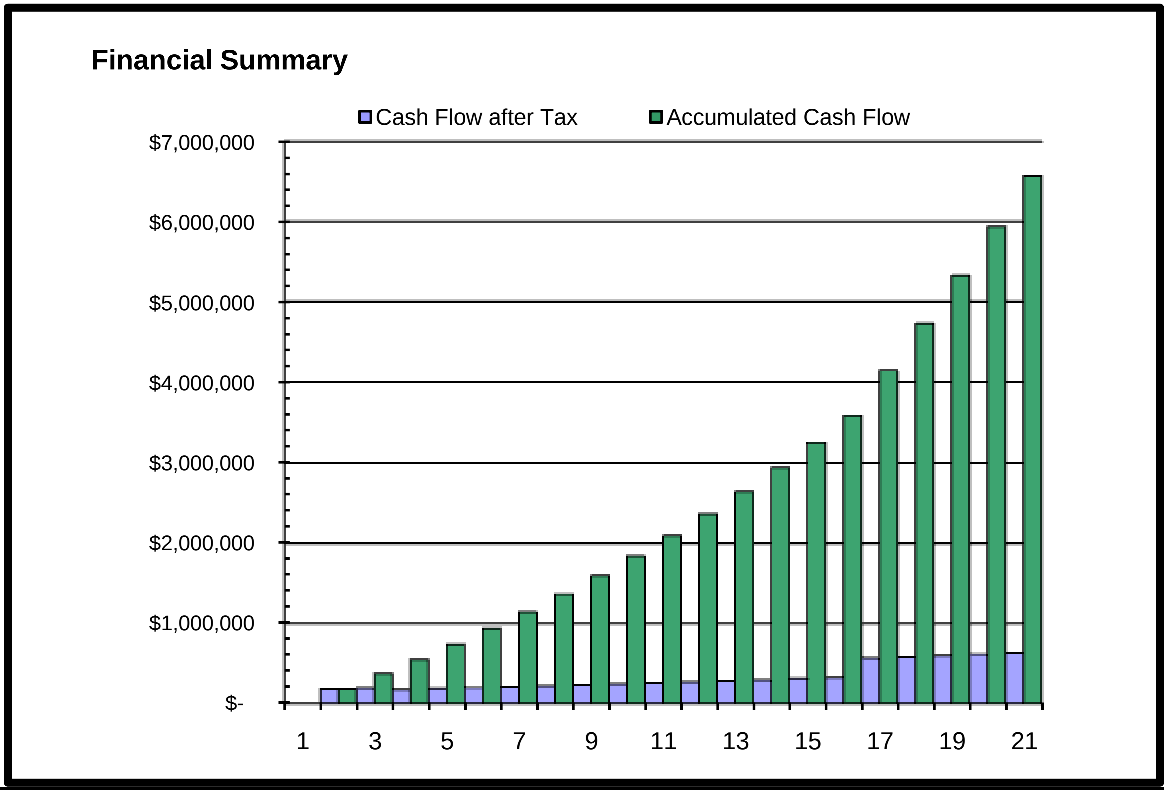
9.3 CLEAN RENEWABLE ENERGY BONDS (CREBs)

As an addition to the low cost, municipal bond financing option, the project team may also explore a Clean Renewable Energy Bond (CREB) for the project which may be available to a project such as the UD-Lewes wind turbine installation. A CREB is a special type of bond, known as a "tax credit bond" that offers public entities the equivalent of an interest-free loan for financing qualified energy projects for a limited term. This bond requires a competitive application process and the term is generally limited to 75% of the project design life. For this analysis, the UD would employ a CREB for 15 years at 1% interest (1% represents the amortized value of the transaction cost in securing a CREB bond from the US treasury). The analysis was performed on the project with the energy escalation rate 3%.

Figure 9-6 Payback Term and 20 Year SavingS for the GE 1.5MW Wind Turbine with CREB Financing

Year 1 Savings	Lifetime Savings
$181,749	$6,569,761

Figure 9-7 Cash Flow Graph for CREB Financing Baseline Scenario at 3% Utility Escalation Rate



APPENDIX A

Electrical System Impact Study

R I C H A R D   C .   G R O S S   P . E . ,   I N C .
RENEWABLE ENERGY PLANNING

April 15, 2009

Mr. Matthew Vanderbrook
Sustainable Energy Developments, Inc.
317 Route 104
Ontario, NY 14519-8958

VIA EMAIL

Dear Matt:

UNIVERSITY OF DELAWARE LEWES CAMPUS
WIND TURBINE GENERATOR FEASIBILITY STUDY

This letter report presents the results of the electrical interconnection analysis for a 1.5 MW wind turbine generator installation at the University of Delaware Lewes Campus.

Executive Summary:

The supplying electric utility to the University of Delaware Lewes Campus ("Lewes Campus") is the Board of Public Works of the City of Lewes ("Lewes BPW"). The electrical interconnection analysis is focused on the Lewes BPW and the Lewes Campus facilities on Pilottown Road in the vicinity of the Cannon Laboratory and Smith Laboratory. The Lewes BPW electrical supply to these facilities is from a three phase, 12.47 kV overhead circuit on Pilottown Road as shown on the attached Exhibit 1.

In response to a request to the Lewes BPW for their requirements and application procedures for interconnecting the 1.5 MW wind turbine generator, the Lewes BPW provided a document entitled "Technical Considerations Covering Parallel Operations of Customer Owned Generation" dated June 21, 2007. Although this document is intended for generators rated 500 kW or less, the Lewes BPW indicated that it could serve as a general guideline for this project. Larger generators such as this project will be considered by the Lewes BPW on a case by case basis.

Using the guidelines provided by the Lewes BPW, two alternative interconnection plans for the 1.5 MW wind turbine generator have been developed as shown on the attached Exhibits 2 and 3. The first alternative, referred to as "12.47 kV Interconnection Option 1," is to interconnect the wind turbine generator to an extension of the existing Lewes BPW 12.47 kV overhead circuit. The second alternative, referred to as "12.47 kV Interconnection Option 2," is to interconnect the wind turbine generator to the 12.47 kV junction equipment located inside the transformer vault that supplies the Cannon Laboratory via an underground, 12.47 kV circuit.

Interconnection Option 1 is the preferred option because it does not require any modification to the existing electrical equipment that supplies the Lewes Campus facilities and it is the least expensive (the electrical interconnection cost estimate is $473K as detailed on Exhibit 4). However, in order to maximize the economic benefit of the wind turbine generator, this option would require the Lewes BPW to allow the electrical energy produced by the wind turbine generator to be credited to the electrical energy usage of one or more buildings on the Lewes Campus. Otherwise, the energy produced by the wind turbine generator would be sold at wholesale.

Interconnection Option 2 would create an actual "behind-the-meter" interconnection of the wind turbine generator at the Cannon Laboratory. The existing Lewes BPW meter that measures the electrical energy usage of the Cannon Laboratory is located at the secondary of the 12.47 kV – 480 volt transformer bank that supplies the Laboratory. In order to maximize the economic benefit of the wind turbine generator, the Lewes BPW meter would be relocated to the primary of the 12.47 kV – 480 volt transformer bank that supplies the Laboratory. The electrical interconnection cost estimate for Option 2 is $648K as detailed on Exhibit 5.

Cannon Laboratory was selected for Interconnection Option 2 because it has the largest energy usage of the Lewes Campus facilities in the vicinity of the proposed wind turbine generator location. Energy produced by the wind turbine generator in excess of the Laboratory usage would be sold at wholesale unless the Lewes BPW allows another arrangement. If it is selected, Interconnection Option 2 could be further developed to include the existing 12.47 kV backup circuit to the Lewes BPW riser that supplies the Smith Laboratory.

Existing Electrical Supply to the Lewes Campus

As shown in Exhibit 1, the Lewes Campus buildings in the vicinity of the proposed wind turbine generator location are supplied from an overhead 12.47 kV, three phase circuit on Pilottown Road.

The Maintenance Operations Building ("MOB") is supplied by a three phase, underground tap from Lewes BPW Pole # 78693 to a three phase transformer bank consisting of three transformers rated 100 kVA each that are located on a slab enclosed by a fence. The transformers each have a dual rated primary voltage rating (2400/4160 x 7200/12470 volt) that is connected on the 7200/12470 volt tap. The transformer secondary rating is 120/240 volts. The primary windings of the transformers are connected in an ungrounded wye configuration and the secondary windings of the transformers are connected in a delta configuration. The secondary of one transformer has a center-grounded tap to provide 120 volts to ground on two of the phases and 208 volts to ground on the other phase. The phase to phase secondary voltage is 240 volts. The Lewes BPW revenue meter for the MOB is located adjacent to the slab and is supplied by three (3) current transformers on the secondary leads of the transformer bank with a 400:5 ampere ratio.

The Cannon Laboratory is supplied by a three phase overhead tap from Pilottown Road to Lewes BPW Pole # 78558 at which point the tap transitions to an underground 12.47 kV cable circuit to a transformer vault. The transformer vault includes a 5-way 12.47 kV junction point and a bank of three transformers rated 333 kVA each. The transformers each have a dual rated primary voltage rating (2400/4160 x 7200/12470 volt) that is connected on the 7200/12470 volt tap. The transformer secondary rating is 277/480 volts. The primary windings of the transformers are connected in a grounded wye configuration and the secondary windings of the transformers are connected in a grounded wye configuration. The five way junction includes a position for a 12.47 kV backup circuit to the Lewes BPW tap that supplies the Smith Laboratory. The Lewes BPW revenue meter for Cannon Lab is located adjacent to the vault and is supplied by three (3) current transformers on the secondary leads of the transformer bank with a 800:5 ampere ratio.

The Smith Laboratory is supplied by a three phase overhead tap from Pilottown Road to Lewes BPW Pole # 78393 at which point the tap transitions to an underground 12.47 kV cable circuit to a padmounted sectionalizing cabinet located between Cannon and Smith Labs. The padmounted sectionalizing cabinet includes a 4-way 12.47 kV junction point that is connected to the 12.47 kV supply circuit to the Smith Laboratory supply transformer. The Smith Lab supply transformer is a three phase, outdoor, padmounted transformer rated 1000 kVA with a voltage rating of 12.47 kV – 120/208 volt. The Lewes BPW revenue meter for the Smith Lab is located on the padmounted transformer and supplied by current transformers located on the secondary leads of the padmounted transformer.

The 12.47 kV backup circuit to the Cannon Lab is terminated on parking stands in the padmounted sectionalizing cabinet and is therefore not normally connected to the Lewes BPW tap that supplies the Smith Laboratory. The 4-way 12.47 kV junction point includes a position to connect the backup circuit to the Cannon Lab.

<u>12.47 kV Interconnection Option 1</u>

Interconnection Option 1 is to extend the existing Lewes BPW 12.47 kV overhead circuit past the point at which it presently terminates to supply the Lewes Campus Conference Center to the proposed wind turbine generator location, a distance of approximately 2300 circuit feet. At the wind turbine generator, the 12.47 kV overhead circuit will transition to an underground circuit and connect to the wind turbine generator as shown on Exhibit 2.

The 12.47 kV generator interconnection circuit will include a 12.47 kV gang operated disconnect switch to provide a controllable switching point between the wind turbine generator and the Lewes BPW 12.47 kV distribution system. The disconnect switch will provide an obvious point of disconnection that can be verified by visual observation. Lewes BPW operations personnel will be able to manually open and padlock this disconnect switch in the open position to guarantee that the wind turbine generator will not energize their 12.47 kV distribution system while they are working on it or when they otherwise deem it necessary.

Lewes BPW primary revenue metering will be provided at the overhead to underground transition point of the wind turbine generator interconnection circuit. The Lewes BPW meter will be bi-directional to measure both the export of the wind turbine generator output to the Lewes BPW distribution system and the supply of auxiliary load from Lewes BPW to the wind turbine generator when there is no wind. In order to maximize the economic benefit of the wind turbine generator, this option would require the Lewes BPW to allow the electrical energy produced by the wind turbine generator to be credited to the electrical energy usage of one or more buildings on the Lewes Campus. Otherwise, the energy produced by the wind turbine generator would be sold at wholesale.

In order to connect the wind turbine generator to the Lewes BPW 12.47 kV distribution system, a three phase generator step-up transformer will be utilized to convert the 690 volt generator voltage to the 12.47 kV system voltage. The generator step-up transformer will be located at the base of the wind turbine generator. The generator step-up transformer will be three phase transformer and capable of carrying the maximum power output of the wind turbine generator plus a margin for the current associated with the generator reactive power consumption/production. For the 1.5 MW wind turbine generator, the generator step-up transformer will be rated 1.75 MVA.

The underground portion of the 12.47 kV generator interconnection circuit will consist of three (3), single conductor, cables with a minimum capacity of 80 amperes per phase (the full-capacity output current of the wind turbine generator). The can be accommodated by #2 AWG, Aluminum power cables. It is recommended that the cables be installed in an underground conduit for physical protection rather than being directly buried.

The wind turbine generator will be equipped with a main circuit breaker and contactor assembly that will automatically open upon a signal from the protective relays that will be required by Lewes BPW for interconnection of generation to their distribution system. The protective relays detect abnormal circuit conditions that would require the wind turbine generator to be disconnected from the rest of the 12.47 kV system.

The required protective relays and interconnection equipment will be specified by Lewes BPW based on the results of their system impact study. The protective relays that Lewes BPW will likely require include over/under voltage relays, over/under frequency relays, and overcurrent relays. These protective relay functions can be provided by a utility-grade protective relay such as the Schweitzer SEL-547 multifunction protective relay.

The wind turbine generator will only operate while connected to Lewes BPW; it is not intended to be a standby power source and it will automatically disconnect from the grid during an outage of the Lewes BPW system.

Interconnection Option 1 is the preferred option because it does not require any modification to the existing electrical equipment that supplies the Lewes Campus facilities and it is the least expensive ($473K, see Exhibit 4). However, in order to maximize the economic benefit of the wind turbine generator, this option would require the Lewes BPW to allow the electrical energy produced by the wind turbine generator to be credited to the electrical energy usage of one or more buildings on the Lewes Campus. Otherwise, the energy produced by the wind turbine generator would be sold at wholesale.

12.47 kV Interconnection Option 2

Interconnection Option 2 is to interconnect the wind turbine generator to the 12.47 kV junction located inside the transformer vault that supplies the Cannon Laboratory via an underground, 12.47 kV circuit from Cannon Lab to the proposed wind turbine generator location, a distance of approximately 2600 circuit feet. At the wind turbine generator, the underground 12.47 kV circuit will be connected to the wind turbine generator as shown on Exhibit 3.

The underground 12.47 kV generator interconnection circuit will consist of three (3), single conductor, cables with a minimum capacity of 80 amperes per phase (the full-capacity output current of the wind turbine generator). The can be accommodated by #2 AWG, Aluminum power cables. It is recommended that the cables be installed in an underground conduit for physical protection rather than being directly buried.

The wind turbine generator interconnection equipment for Option 2 will include a free-standing, outdoor, switchgear unit consisting of a three pole, group-operated, 12.47 kV disconnect switch and fuse assembly. This will provide a protection and switching point within sight the wind turbine generator that can also be verified by viewing the position of the disconnect switch blades ("visible open"). An overhead, 12.47 kV disconnect switch is also provided at the Lewes BPW overhead/underground transition supply point to the Cannon Lab as will be required by the Lewes BPW. Lewes BPW operations personnel will need access to manually open and padlock the disconnect switch in the open position to guarantee that the wind turbine generator will not energize their 12.47 kV distribution system while they are working on it or when they otherwise deem it necessary.

The 12.47 kV backup circuit from Cannon Lab to the Lewes BPW tap that supplies the Smith Laboratory is not included on the Option 2 electrical one line diagram to highlight the necessity to prevent an unsupervised interconnection of the wind turbine generator to the Lewes BPW tap. If Option 2 is selected, it would be possible to develop a switching plan that would disconnect the wind turbine generator before connecting Cannon Lab to the 12.47 kV backup circuit.

Interconnection Option 2 would create an actual "behind-the-meter" interconnection of the wind turbine generator at the Cannon Laboratory. The existing Lewes BPW meter that measures the electrical energy usage of the Cannon Laboratory is located at the secondary of the 12.47 kV – 480 volt transformer bank that supplies the Laboratory. In order to maximize the economic benefit of the wind turbine generator, the Lewes BPW meter will have to be relocated to the primary of the 12.47 kV – 480 volt transformer bank that supplies the Laboratory.

Under normal conditions, the wind turbine generator output will flow from the wind turbine generator, through the 12.47 kV – 690 volt generator step-up transformer, to the underground 12.47 kV interconnection circuit. During periods when the Cannon Lab power consumption exceeds the wind turbine generator output, the wind turbine generator output will share in the power supplied by Lewes BPW to the Lab, thereby reducing the amount of power supplied by Lewes BPW. When wind turbine generator production exceeds the Cannon Lab consumption, the excess wind turbine generator output will flow to the Lewes BPW 12.47 kV distribution system and share in the supply of power to other Lewes BPW customers.

The Lewes BPW primary revenue meter will be capable of measuring electrical power that flows in both directions (bi-directional). In addition, a kWh meter will be installed at the output terminals of the wind turbine generator to measure the wind turbine generator energy production.

Lewes BPW Generator Interconnection Application and Study Process

The conceptual interconnection plans presented in this report are based on interconnecting the wind turbine generator to the Lewes BPW circuit in the vicinity of the Lewes Campus. The final generator interconnection plan will be determined on the basis of Lewes BPW's generator interconnection application and study procedures.

Lewes BPW's generator interconnection application and study procedures are generally outlined in the Lewes BPW document entitled "Technical Considerations Covering Parallel Operations of Customer Owned Generation" dated June 21, 2007. Although this document is intended for generators rated 500 kW or less, the Lewes BPW indicated that it could serve as a general guideline for larger generators. Larger generators will be considered by the Lewes BPW on a case by case basis.

The Lewes BPW study may identify upgrades to the Lewes BPW electrical distribution system that are determined to be necessary to alleviate system impacts caused by the interconnection of the wind turbine generator. Please note that the cost estimates provided in Exhibits 4 and 5 do not include allowances for Lewes BPW system upgrades necessary to alleviate system impacts.

Please contact me if you have any questions or comments regarding this letter report.

10 SPEEN STREET • FRAMINGHAM, MASSACHUSETTS 01701
PHONE: 508-665-5805 EMAIL: RGROSS@IEEE.ORG

Sincerely,

Richard C. Gross
Principal

Enclosures

10 SPEEN STREET • FRAMINGHAM, MASSACHUSETTS 01701
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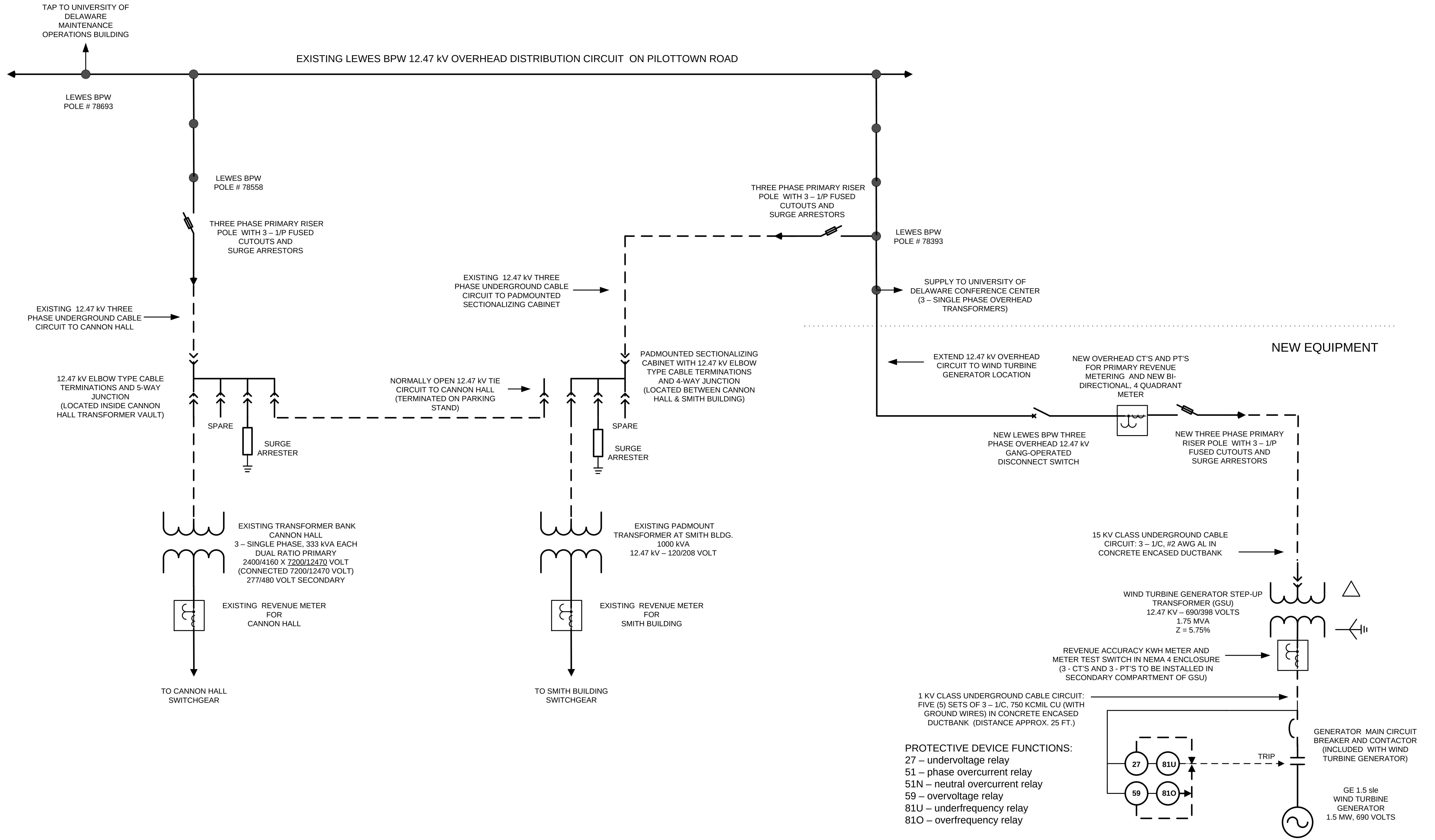
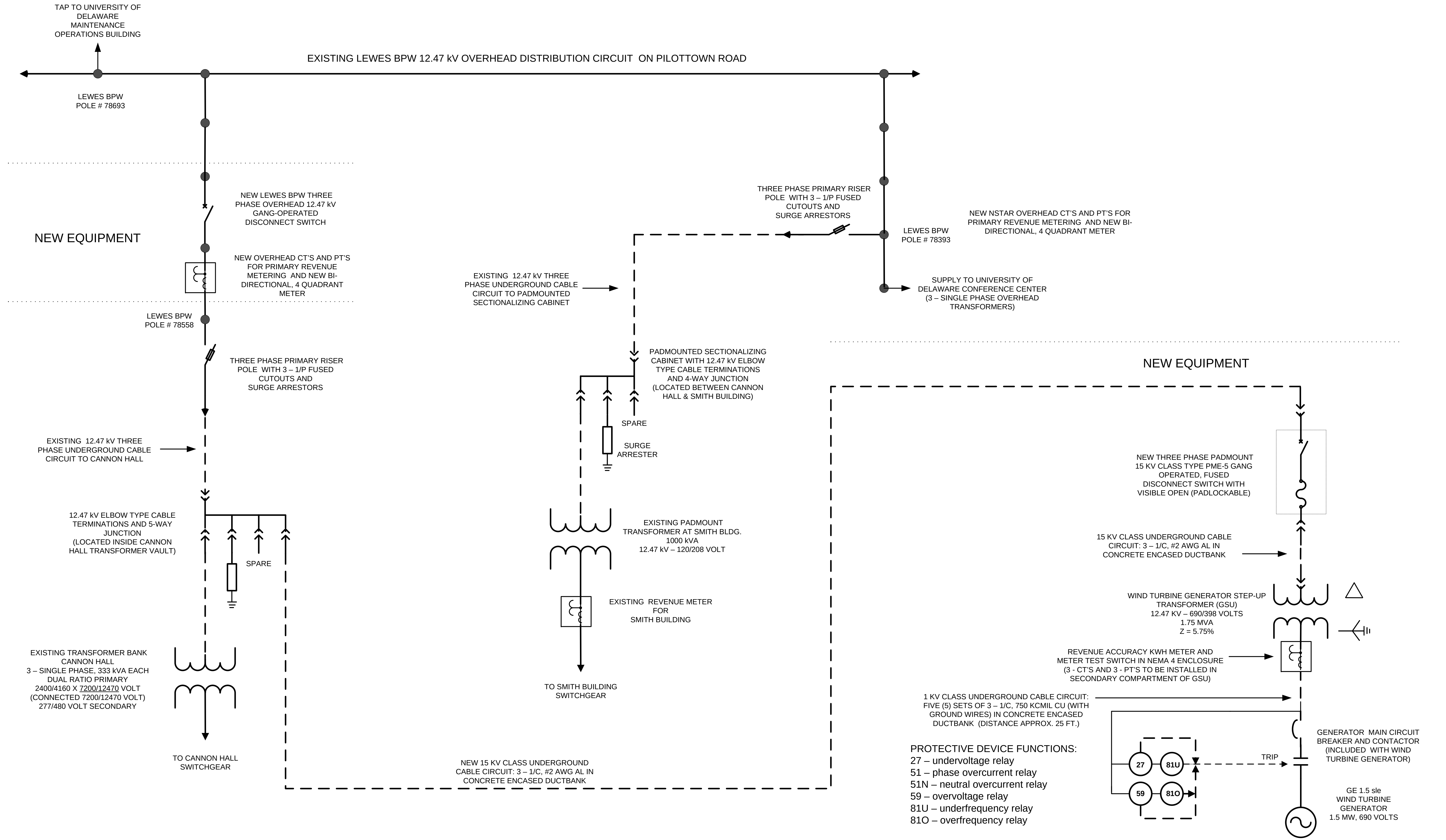
APPENDIX B

Interconnection One-Line Diagrams



RICHARD C. GROSS P.E., INC.
14APRIL2009

UNIVERSITY OF DELAWARE LEWES CAMPUS
1.5 MW WIND TURBINE GENERATOR PROJECT
ELECTRICAL ONE LINE DIAGRAM
12.47 kV INTERCONNECTION OPTION 1



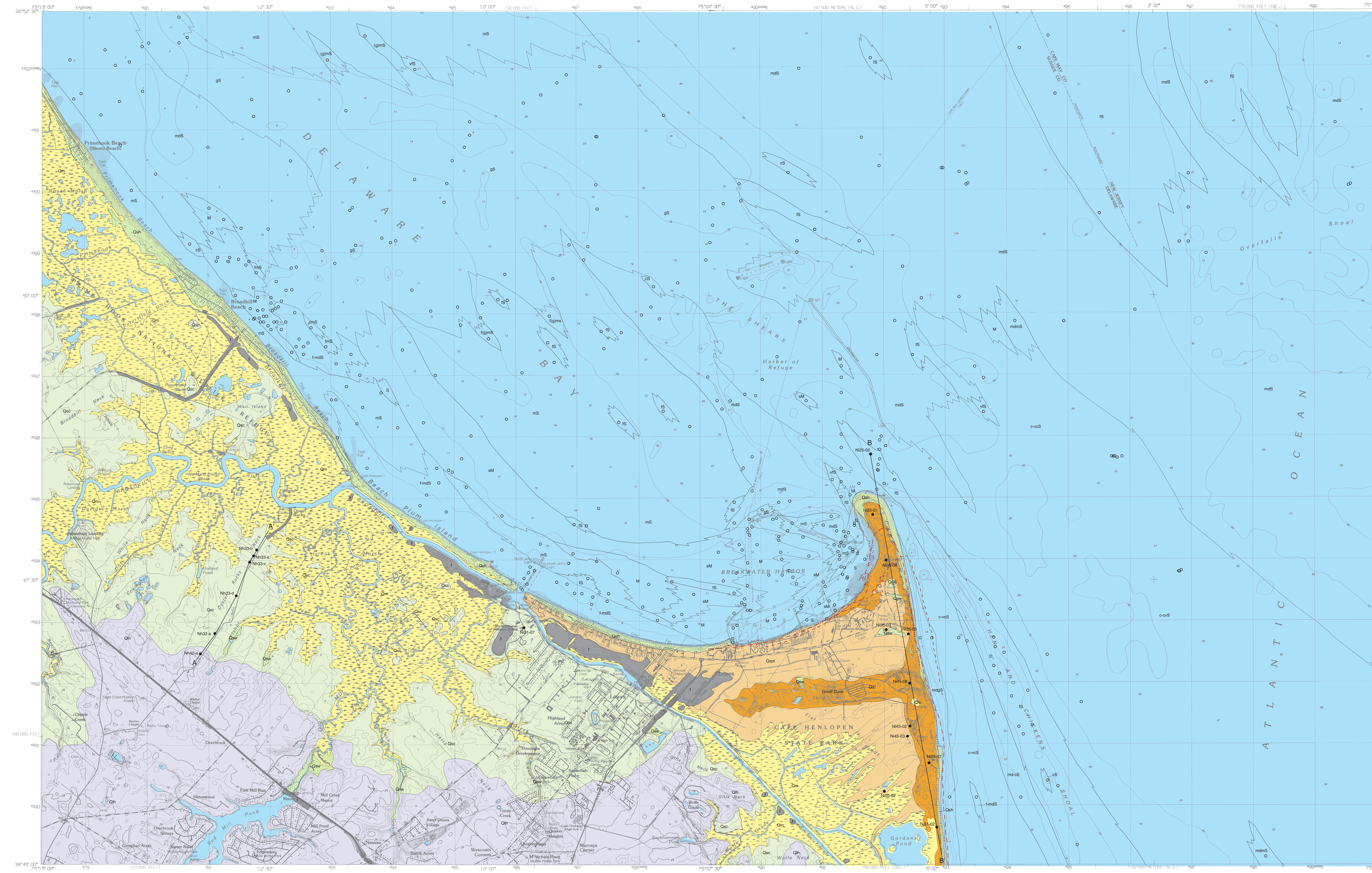
RICHARD C. GROSS P.E., INC.
14APRIL2009

UNIVERSITY OF DELAWARE LEWES CAMPUS
1.5 MW WIND TURBINE GENERATOR PROJECT
ELECTRICAL ONE LINE DIAGRAM
12.47 kV INTERCONNECTION OPTION 2

APPENDIX C

Geologic Map of Lewes and Cape Henlopen

DELAWARE GEOLOGICAL SURVEY



GEOLOGIC MAP OF THE LEWES AND CAPE HENLOPEN QUADRANGLES, DELAWARE

by

Kelvin W. Ramsey
2003

Base maps from the United States Geological Survey
Lewes and Cape Henlopen Quadrangles,
7.5-minute series, 1997.

North American Datum of 1983 (NAD83).
Projection of 100-meter grid: Universal Transverse Mercator, zone 18
10,000-foot grid ticks: Delaware Coordinate System
2,500-meter grid ticks: New Jersey Coordinate System of 1983

QUADRANGLE LOCATION

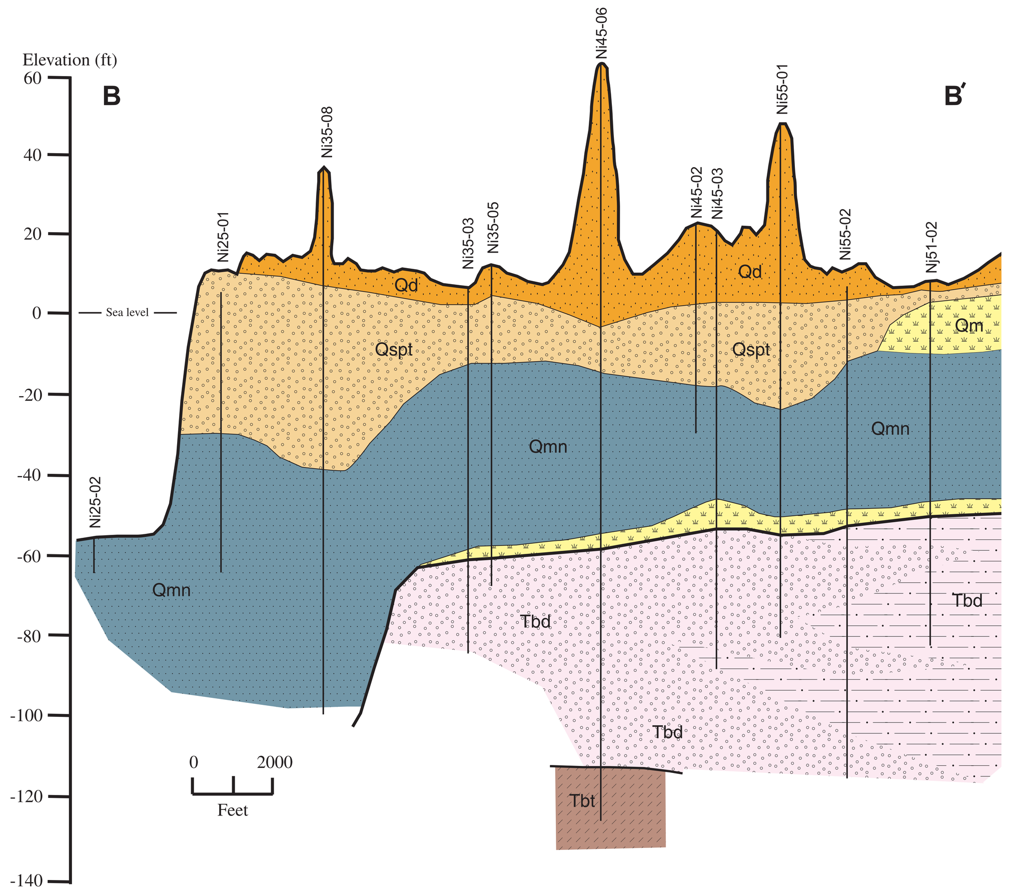
UTM GRID AND 1992 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

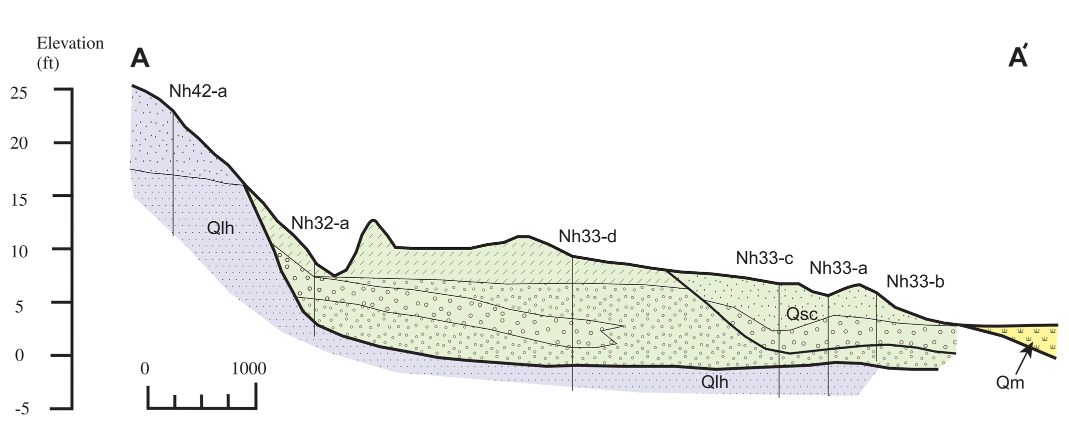
CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 29)
(TO CONVERT ELEVATIONS TO THE NORTH AMERICAN VERTICAL DATUM OF 1988, SUBTRACT 1 FOOT)

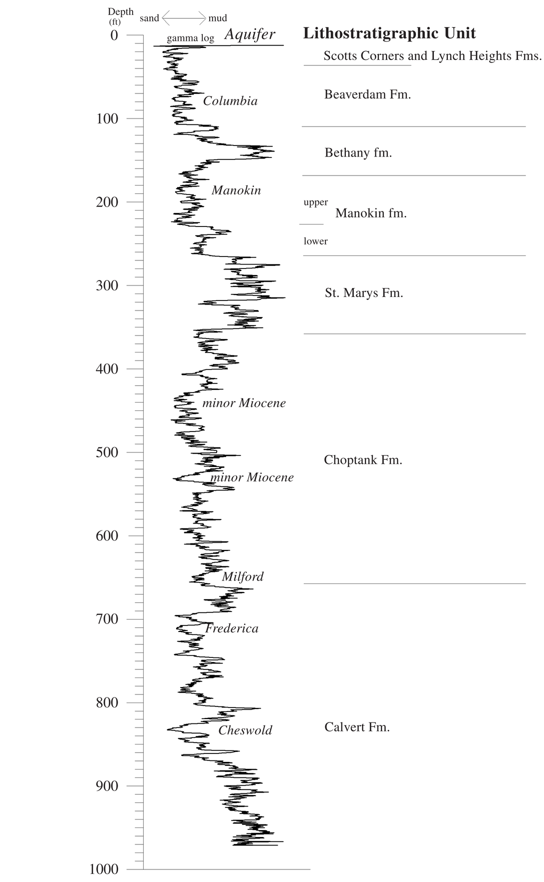
SYMBOLS

- Ni 45-02 Well or borehole
- Nh42-a Outcrop or soil auger boring
- Borrow pit
- Offshore core or grab sample
- 1884 shoreline
- 1944 shoreline
- 1977 shoreline
- formation contact (on cross-sections)



- Organic-rich mud
- Silt with very fine sand
- Interbedded coarse sand and clayey fine sand
- Very fine to fine sand
- Medium to fine sand
- Coarse to very coarse sand
- Gravelly sand to gravel





QUATERNARY
HOLOCENE

- Qsh Shoreline deposits
- Qd Dune deposits
- Qspt Spit deposits
- Qm Marsh deposits
- Qsw Swamp deposits
- Qmn Marine deposits (subsurface only)

PLEISTOCENE

- Qsc Scotts Corners Formation
- Qlh Lynch Heights Formation

TERTIARY
PLIOCENE

- Tbd Beaverdam Formation (subsurface only)
- Tbt Bethany formation (subsurface only)

MIOCENE

- Tm Manokin formation (subsurface only)
- Tsm St. Marys Formation (subsurface only)
- Tch Choptank Formation (subsurface only)
- Tc Calvert Formation (subsurface only)

EXPLANATION

FILL — f

Fill consists of man-made deposits of natural earth material used to extend shore land and/or to fill a low-lying area such as where a road crosses a valley or marsh. Most of the fill in the map area is dredged marsh deposits from channel construction and deepening through the marshes. Some construction debris (concrete, bricks, etc.) may be incorporated in the unit. Holocene.

SHORELINE DEPOSITS — Qsh

Shoreline deposits consist of beach and dune deposits found along the shorelines of Delaware Bay and the Atlantic Ocean. Beach deposits consist of medium to coarse sand with pebbles and cobbles. Laminae of opaque heavy minerals and very coarse sand to pebbles are common. Pebble and cobble lithologies are dominated by quartz and chert (commonly containing Paleozoic fossils) with lesser amounts of quartzite, sandstone, and siltstone. Along the margin of Delaware Bay, the unit includes small dunes consisting of fine to medium, well-sorted sand with discontinuous opaque heavy mineral laminae. Shoreline deposits interfinger with, or unconformably overlie, organic-rich mud of the marsh and swamp deposits, dune deposits, or sands of the Scotts Corners Formation. Thickness of the unit is generally less than 20 feet. Holocene.

DUNE DEPOSITS — Qd

Dune deposits consist of fine to coarse, cross-bedded quartz sand. Laminae of opaque heavy minerals are common, and laminae of pebbles are rare to common. The unit forms a large dune field that is parallel to the Atlantic Coast and joins with another dune field perpendicular to the coast (the Great Dune). The unit lies conformably to unconformably on the spit deposits of Cape Henlopen. Thickness ranges from 3 to 75 feet. Holocene.

SPIT DEPOSITS — Qspt

Spit deposits consist of interbedded fine to coarse sand, gravelly sand, silty sand, and sandy silt. Scattered shelly beds are also present. The unit represents the spit complex of Cape Henlopen that has prograded into the mouth of Delaware Bay and overlies marine deposits. Thickness of the unit ranges from 3 to 80 feet. Holocene.

MARSH AND SWAMP DEPOSITS — Qm, Qsw

Marsh deposits consist of structureless to finely laminated, black to dark gray, organic-rich silty clay to clayey silt with discontinuous beds of peat and with rare shells. In-place or transported fragments of marsh grasses such as *Spartina* are common. Includes some clayey silts of estuarine channel origin. It interfingers with swamp deposits and spit deposits and unconformably overlies sands of the Scotts Corners, Lynch Heights, and Beaverdam Formations. Map area delineated on the basis of distribution of salt-tolerant marsh grasses. The unit can be up to 40 feet thick. Holocene.

Swamp deposits consist of structureless, black to brown, organic-rich, silty and clayey, fine to coarse quartz sand with thin interbeds of medium to coarse quartz sand. Organic particles consist of leaves, twigs, and larger fragments of deciduous plants. The swamp deposits fine upwards and grade laterally with marsh deposits. Overlies the Scotts Corners and Lynch Heights Formations. Swamp deposits are defined primarily on the presence of deciduous vegetation in stream valleys. In the upper reaches of streams, they contain alluvial deposits consisting of fine to coarse quartz sand with pebbles. These alluvial deposits are too geographically restricted to show as individual map units. The unit can be up to 20 feet thick. Holocene.

MARINE DEPOSITS (Subsurface only) — Qmn

Marine deposits consist of fine to very fine sand to sandy silt with laminae to thin beds of clayey silt to silty clay. Scattered shells are common. These deposits represent marine to estuarine sediments deposited at the mouth of Delaware Bay upon which the spit of Cape Henlopen accreted. This unit can be up to 60 feet thick. Holocene.

SCOTTS CORNERS FORMATION — Qsc

The Scotts Corners Formation is a heterogeneous unit of light gray to brown to light yellowish brown coarse to fine sand, gravelly sand, and pebble gravel with rare discontinuous beds of organic-rich clayey silt and clayey silt. Sands are quartzose with some feldspar and muscovite. It is commonly capped by one to two feet of silt to fine sandy silt. Laminae of opaque heavy minerals are common. The unit unconformably overlies the Lynch Heights Formation. The basal contact is marked by a coarse sand to gravelly sand bed overlying an oxidized, compact horizon (paleosol) at the top of the Lynch Heights. Overall thickness of the unit rarely exceeds 15 feet. The Scotts Corners is interpreted to be a transgressive unit consisting of swamp, marsh, estuarine channel, beach, and bay deposits. Climate during the time of deposition was temperate to warm temperate as interpreted from fossil pollen assemblages. Late Pleistocene.

LYNCH HEIGHTS FORMATION — Qlh

The Lynch Heights Formation is a heterogeneous unit of light gray to brown to light yellowish brown medium to fine sand with discontinuous beds of coarse sand, gravel, silt, fine to very fine sand, and organic-rich clayey silt to silty sand. The upper part of the unit commonly consists of fine well-sorted sand. Small-scale cross-bedding within the sands is common. Some of the interbedded clayey silts and silty sands are burrowed. Beds of shell are rarely encountered. Sands are quartzose and slightly feldspathic, and typically micaceous where very fine to fine grained. The Lynch Heights is distinguished from the Scotts Corners by its greater thickness, characteristic interbedded sands and silts (primarily in areas where it is the surficial unit), its unique pollen assemblage, and a general lack of a well-defined silt cap that characterizes the Scotts Corners.

The Lynch Heights is interpreted to be a fluvial to estuarine unit of fluvial channel, tidal flat, tidal channel, beach, and bay deposits. In the Lewes and Cape Henlopen quadrangles it is interpreted to represent spit and dune deposits much like those found on the adjacent modern counterpart, Cape Henlopen. It unconformably overlies the Beaverdam Formation. Climate during deposition was cool-temperate, slightly cooler than that indicated for the Scotts Corners. The unit is up to 50 feet thick to the east and thins to the west. Late Pleistocene.

BEAVERDAM FORMATION (subsurface only) — Tbd

The Beaverdam Formation consists of yellow-orange, light brown, and light gray, silty, fine to medium quartzose to moderately feldspathic sand, sandy silt, clayey sandy silt, and coarse sand with a white to light yellow silt or clay matrix, with beds of dark gray to brown organic-rich clayey silt. Also common within the Beaverdam are light yellow-orange, medium to coarse sand, gravelly sand, and sandy gravel with rare beds of dark gray or blue- to gray, silty clay to clayey silt. The basal beds of the unit are commonly gravelly. Rare cobbles and boulders are also found. Pebbles and cobbles are dominantly quartz and quartzite, with lesser amounts of sandstone, chert, and a variety of lithic clasts. The base of the Beaverdam is a highly irregular surface with as much as 40 feet of relief. The weathered Beaverdam is brightly colored white, red, and orange and contains highly weathered grains of feldspar and degraded kaolinitic clays. The unit unconformably overlies the Manokin or St. Marys Formations. The Beaverdam is interpreted to be a fluvial to estuarine deposit. The unit ranges up to 100 feet thick in the map area. Pliocene.

BETHANY FORMATION (subsurface only) — Tbt

Informal unit. The Bethany formation consists of gray, olive gray, and bluish-gray clay to clayey silt interbedded with fine to very coarse sand. Lignitic and gravelly beds are common. This unit is distinguished from the adjacent Beaverdam and Manokin Formations by its overall finer-grained nature. The unit possibly is a more marine facies of the Beaverdam Formation and interfingers with that unit updip. It unconformably overlies the Manokin formation and is 50 to 75 feet thick in the map area. Late Miocene to Pliocene.

MANOKIN FORMATION (subsurface only) — Tm

Informal unit. The Manokin formation is subdivided into two units, an upper unit (Manokin B) and a lower unit (Manokin A). The upper unit consists of well-sorted, clean, white to reddish brown, fine to medium sand. Some beds of medium to coarse sand and gray to white clayey silt are also present. The lower unit consists of gray, very fine silty sand to silty clay with rare to common pieces of lignite. The upper and lower units have conformable to unconformable relationships. The lower Manokin rests conformably to unconformably on the St. Marys Formation. The Manokin is interpreted to be an estuarine to marine deposit within a deltaic setting. It ranges from 50 to 100 feet thick in the map area. Late Miocene.

ST. MARYS FORMATION (subsurface only) — Tsm

The St. Marys Formation consists of light gray to gray to brown clayey silt with fine to medium quartz sand and clayey silt. Discontinuous beds of fine to medium to coarse sand and shelly quartz sand are common. It unconformably overlies the Choptank Formation. The St. Marys is interpreted to be a marginal marine deposit. The thickness of the unit ranges from 90 to 160 feet in the map area. Late Miocene.

CHOPTANK FORMATION (subsurface only) — Tch

The Choptank Formation is composed of light gray to blue gray, fine to medium, silty quartz sand and clayey silt. Discontinuous beds of fine sand and medium to coarse sand with shell beds are common. It unconformably overlies the Calvert Formation. Its basal contact is marked by a granular to very coarse sand overlying distinctive brown silty clays of the Calvert. The Choptank is interpreted to be a marine deposit. It is approximately 300 feet thick in the map area. Late Miocene.

CALVERT FORMATION (subsurface only) — Tc

The Calvert Formation consists of light gray to brown clayey silt and fine to medium silty quartz sand. Discontinuous beds of shelly sand and shelly clayey silt are common. It is rarely penetrated by water wells in the map area and is over 300 feet thick. The Calvert is interpreted to be a marine deposit. Middle to late Miocene.

Discussion

The surficial geology of the Lewes and Cape Henlopen quadrangles reflects the geologic history of the Delaware Bay estuary and successive high and low stands of sea levels during the Quaternary. The subsurface Beaverdam Formation was deposited as part of a fluvial-estuarine system during the Pliocene, the sediments of which now form the core of the Delmarva Peninsula. Following a period of glacial outwash during the early Pleistocene represented by the Columbia Formation found to the northwest of the map area (Ramsey, 1997), the Delaware River and Estuary developed their current positions. The Lynch Heights and Scotts Corners Formations (Ramsey, 1993, 1997, 2001) represent shoreline and estuarine deposits associated with high stands of sea level during the middle to late Pleistocene on the margins of the Delaware Estuary. In the map area, the Lynch Heights Formation includes relict spit and dune deposits at the ancestral intersection of the Atlantic Coast and Delaware Bay systems, similar in geomorphic position to the modern Cape Henlopen.

The relationship between the Lynch Heights and Scotts Corners is shown in cross-section A-A'. The Lynch Heights is composed of a fine, well-sorted sand. The break in topography (scarp) between the surface of the Lynch Heights (at approx. 25 ft and higher) and that of the Scotts Corners (at approx. 6 to 15 feet) represents ancestral shorelines of Delaware Bay during a high sea level contemporaneous with the deposition of the Scotts Corners. The cross section also shows two depositional units within the Scotts Corners. A younger shoreline sequence with sand at the land surface has cut into an older unit (marked by silt at the land surface). Gravel beds within both units represent shoreline deposits like those found along the modern Delaware Bay in the area. Two depositional units within the Scotts Corners is consistent with observations of the Scotts Corners by Ramsey (1997) just to the north of the map area. Both of these units were deposited during the last interglacial period. The older unit may be attributed to the high sea stand at 120,000 years B.P. and the younger unit to one at 80,000 years B.P. (Ramsey, 1997).

Quaternary deposits were transgressed by Holocene swamp, marsh, shoreline, estuarine and spit deposits. The spit deposits form the modern Cape Henlopen (Ramsey, et al., 2000, Ramsey, 1999). Cross section B-B' depicts sediment distribution within the Cape Henlopen complex and stratigraphic relationships with units underlying the Holocene spit deposits.

Offshore surficial sediment distribution is a compilation of historical offshore core and grab sample textural descriptions and data (Hoyt, 1982; Maley, 1981; Marx, 1981; Oostdam, 1971; Sheridan et al., 1974; Strom, 1972, 1976; Terchunian, 1985; Weil, 1976; Wethe et al., 1982, 1982a, 1983 and unpublished data in DGS files). From core descriptions, the top six inches was used as the surficial sediment type. Sediment textures shown on the map show a general distribution of sediment size over a large area. Site-specific information about bottom sediment textures may require additional sampling. Refer to the adjacent triangular diagram for sediment texture abbreviations. Historical shoreline positions are from historical U.S. Coast & Geodetic Survey T-sheets (1884) and topographic maps (1944, 1977).

Stratigraphic units found at depth within the map area are shown with the geophysical log of Ni31-07, a 1,035-foot deep geothermal test hole drilled in 1978 for the U.S. Department of Energy. Major aquifer units are also shown (Andres, 1986).

Acknowledgments

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References Cited

Andres, A.S., 1986, Geohydrology of the Northern Coastal Area, Delaware, Sheet 1, Basic Geohydrologic Data , scale 1:24,000.

Folk, R.L., 1974, Petrology of sedimentary rocks: Austin, Texas, Hemphill Publishing Co., 182 p.

Hoyt, W.H., 1982, Processes of sedimentation and geologic history of the Cape Henlopen/Breakwater Harbor area, Delaware: Newark, Delaware, University of Delaware, unpublished Ph.D. dissertation, 343 p.

Maley, K.F., 1981, A transgressive facies model for a shallow estuarine environment: Newark, Delaware, University of Delaware, unpublished M.S. thesis, 184 p.

Marx, P.R., 1981, A dynamic model for an estuarine transgression based on facies variants in the nearshore of western Delaware Bay: Newark, Delaware, University of Delaware, unpublished M.S. thesis, 183 p.

Oostdam, B.L., 1971, Suspended sediment transport in Delaware Bay: Newark, Delaware, University of Delaware, unpublished Ph.D. dissertation, 316 p.

Ramsey, K.W., 1993, Geologic Map of the Milford and Mispillion River quadrangles: Delaware Geological Survey Geologic Map No. 8, scale 1:24,000.

_____ 1997, Geology of the Milford and Mispillion River quadrangles: Delaware Geological Survey Report of Investigations No. 55, 40 p.

_____1999, Cross section of Pliocene and Quaternary deposits along the Atlantic Coast of Delaware: Delaware Geological Survey Miscellaneous Map No. 6.

_____2001, Geologic map of the Ellendale and Milton quadrangles, Delaware: Delaware Geological Survey Geologic Map No. 11, Scale 1:24,000.

Ramsey, K.W., Schenck, W.S., and Wang, L.T., 2000, Physiographic regions of the Delaware Atlantic Coast: Delaware Geological Survey Special Publication No. 25.

Sheridan, R.E., Dill, C.E, and Kraft, J.C., 1974, Holocene sedimentary environment of the Atlantic inner shelf off Delaware: Geological Society of America Bull., 85, p. 1319-1328.

Strom, R.N., 1976, Phosphorus fractionation in estuarine and marsh sediments: Newark, Delaware, University of Delaware, unpublished Ph.D. dissertation, 153 p.

_____ 1972, Sediment distribution in southwestern Delaware Bay: Office of Naval Research Technical Report No. 18, 118 p.

Terchunian, A.V., 1985, Hen and Chickens Shoal, Delaware: evolution of a modern nearshore marine feature: Newark, Delaware, University of Delaware, unpublished masters thesis, 148p.

Weil, C.B., 1976, A model for the distribution, dynamics, and evolution of Holocene sediments and morphologic features of Delaware Bay: Newark, Delaware, University of Delaware, unpublished Ph.D. dissertation, 408 p.

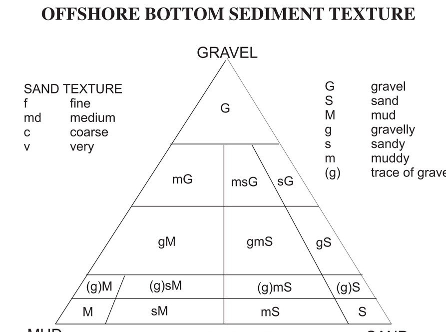
Wethe, C.A., DeSombre, K., Counts, D.M., and Tinsman, C.H., 1982, Sand sources for the renourishment of Broadkill Beach: College of Marine Studies, University of Delaware, Lewes, Delaware, Technical Report MSL-01-82, 16 p. plus appendices.

_____ 1982a, Sand sources for the renourishment of Lewes Beach: College of Marine Studies, University of Delaware, Lewes, Delaware, Technical Report MSL-02-82, 17 p. plus appendices.

Wethe, C.A., Maurmeyer, E.M., and Carey, W.L., 1983, Sampling and analysis of sand resources for Lewes Beach nourishment: Wethe Engineering Associates, Inc., Lewes, Delaware, Technical Report WEA- 01-83, 7 p. plus appendices.

OFFSHORE BOTTOM SEDIMENT TEXTURE

SAND TEXTURE
f fine
md medium
c coarse
v very



G gravel
S sand
M mud
g gravelly
s sandy
m muddy
(g) trace of gravel

Example: gmS (gravelly muddy Sand)

APPENDIX D

Cashflow Model Output Sheets – Baseline Economic Scenarios for Location 1 and Location 2

CONFIDENTIAL to Sustainable Energy Developments, Inc.

Project Economics Unleveraged With Appropriation no Grant

Contact: Kevin Schulte 585 265 2384
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SUSTAINABLE ENERGY DEVELOPMENTS INC.

Prepared for: Udel - Lewes - Site 1 1 x GE SLE 1500kW **Location:** Lewes, DE

Date: 5/19/2009

Project Assumptions

Number of Turbines	1
Total Installed Capacity (kW)	1,500
Average Wind Speed (m/s)	6.7
Wind Speed mph	15.1
Annual Energy Output (kWh)	4,023,750.0
Capacity Factor	31%
Maintenance ($/kWh)	$ 0.012
Annual Maintenance Cost	$ 48,285
Escalation Rate	3.0%
Annual Maintenance Reserve	$ 25,000
Annual Insurance Cost	$ 15,000
Escalation Rate	3.0%
Power Purchase Price ($/kWh)	$ 0.094
Annual Energy Value	$ 377,441
Power Purchase Escalator	(enter below)
REC (Green Tag) Value	(enter below)

Cost Summary

Turbine Cost (per turbine)	$ 2,600,000
Tower Cost (per turbine)	$ -
Installation Cost (incl 100K transaction costs	$ 1,718,673
Development Costs	$ 232,705
Subtotal	$ 4,551,378
Earmark	$ (1,400,000)
Earmark (%)	31%
Net Installed Cost	$ **3,151,378**
Cost/kW	$ 2,101

Cash In Summary

Cash In Summary	0%
Amount to be Financed	
Cash In Total	$ -
Term of Cash Repayment (years)	
Cash Interest Rate (annual)	
Annual Cash Payback	
Monthly Cash Payback	$ -

Equity Summary

Percentage Equity	
Amount of Debt	$ 3,151,378
Amount Equity	$ -
Equity Term (years)	
Equity Interest Rate (annual)	
Annual Equity Payment	#DIV/0!
Monthly Equity Payment	#DIV/0!

Debt Summary

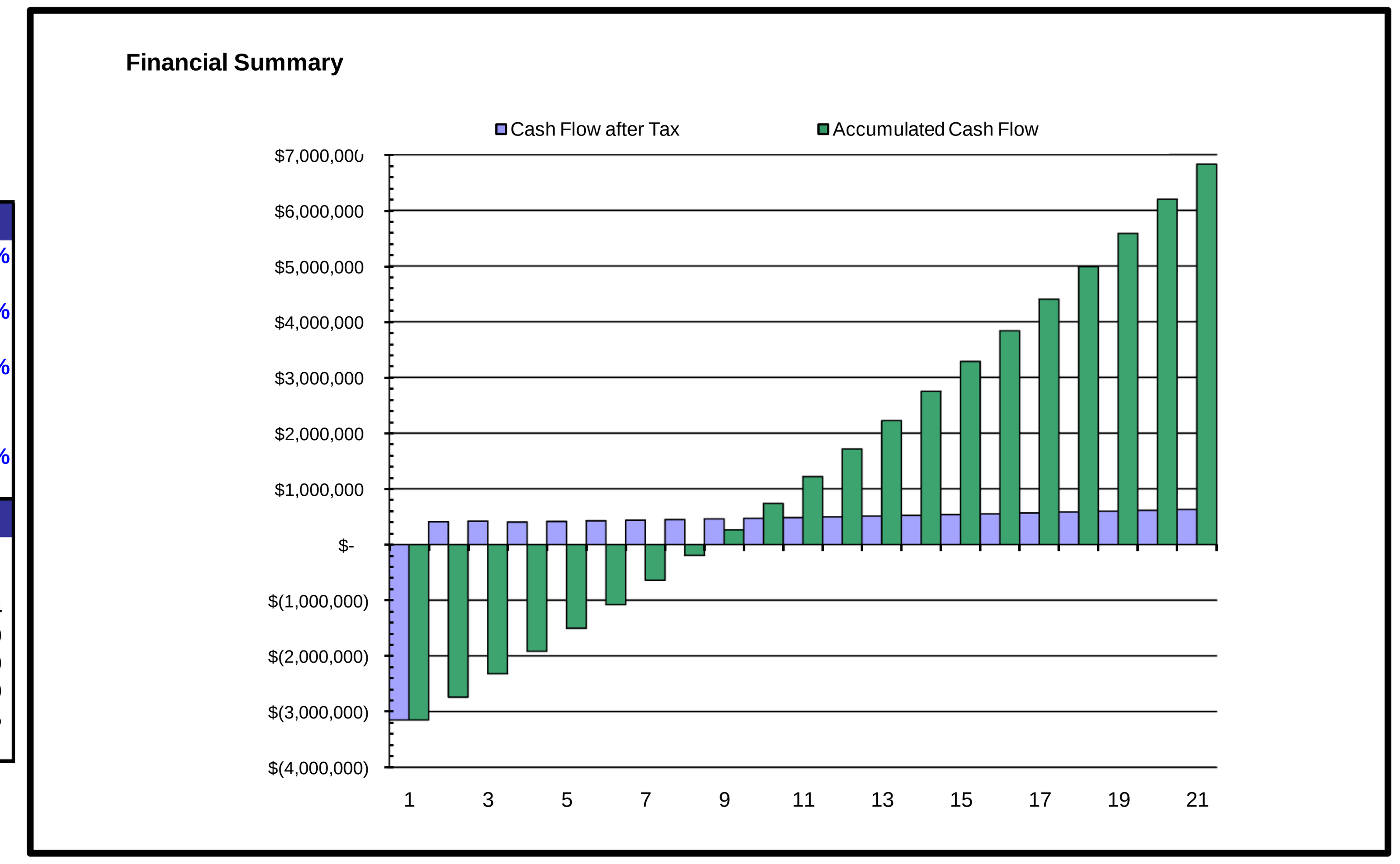
Percentage Debt	0%
Remaining Amount	$ 3,151,378
Amount of Debt	$ -
Debt Term (years)	0
Debt Interest Rate (annual)	0.0%
Annual Debt Payment	#DIV/0!
Monthly Debt Payment	#DIV/0!

Tax & Financial Assumptions

Discount Rate (for NPV)	5.5%
Customer Tax Rate (State+Fed)	0.0%
Investment Tax Credit (%)	0%
Investment Tax Credit ($)	$ -
PTC ($/kWh)	$ -
PTC Inflation	0.0%
PTC Yrs Qualified	-

Results

Internal Rate of Return	13.2%
Payback (years)	7.43
NPV at 5.5%	**$ 2,562,354**
Lifetime Net Savings	$ 6,830,730
Lifetime Energy Output (kWh)	80,475,000
Average Lifetime Cost/kWh of Grid Power	$ 0.130
Lifetime Fixed Cost/kWh of Wind Energy	$ 0.045



Detailed Project Economics Estimate for Udel - Lewes - Site 1

	Total	Levelized Cost / kWh	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Costs													
Up-Front Cost/Down Payment	$ (3,151,378)	($0.039)	$ (3,151,378)										
Annual Cash Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (1,170,566)	($0.015)		$ (20,000)	$ (20,000)	$ (48,285)	$ (49,734)	$ (51,226)	$ (52,762)	$ (54,345)	$ (55,976)	$ (57,655)	$ (59,384)
Maintenance Reserve	$ (500,000)	($0.006)		$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)
Insurance	$ (403,056)	($0.005)		$ (15,000)	$ (15,450)	$ (15,914)	$ (16,391)	$ (16,883)	$ (17,389)	$ (17,911)	$ (18,448)	$ (19,002)	$ (19,572)
Total Costs	$ (5,225,000)	($0.065)	$ (3,151,378)	$ (60,000)	$ (60,450)	$ (89,199)	$ (91,124)	$ (93,108)	$ (95,151)	$ (97,256)	$ (99,424)	$ (101,656)	$ (103,956)
PV of Costs	$ (4,324,011)	($0.054)	$ (3,151,378)	$ (56,872)	$ (54,311)	$ (75,963)	$ (73,557)	$ (71,240)	$ (69,008)	$ (66,857)	$ (64,784)	$ (62,786)	$ (60,859)
Benefits													
Utility Escalation Rate				3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 10,446,230	$0.130		$ 388,764	$ 400,427	$ 412,440	$ 424,813	$ 437,557	$ 450,684	$ 464,204	$ 478,130	$ 492,474	$ 507,249
REC (Green Tag) Value ($/kWh)		$0.000		$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020
REC (Green Tag) Value ($)	$ 1,609,500	$0.020		$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475
Total Income	$ 12,055,730	$0.150		$ 469,239	$ 480,902	$ 492,915	$ 505,288	$ 518,032	$ 531,159	$ 544,679	$ 558,605	$ 572,949	$ 587,724
PV of Income	$ 6,886,365	$0.086		$ 444,776	$ 432,067	$ 419,773	$ 407,877	$ 396,364	$ 385,221	$ 374,433	$ 363,987	$ 353,870	$ 344,071
Income Tax Impact													
Investment Tax Credit	$ -		$ -										
5-yr MACRS Double Declining Balance Sched.			60.00%	16.00%	9.60%	5.76%	5.76%	2.88%					
Tax Value of MACRS 5-year Depreciation	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 12,055,730	$0.150	$ -	$ 469,239	$ 480,902	$ 492,915	$ 505,288	$ 518,032	$ 531,159	$ 544,679	$ 558,605	$ 572,949	$ 587,724
Maintenance + Insurance	$ (1,573,622)	($0.020)		$ (35,000)	$ (35,450)	$ (64,199)	$ (66,124)	$ (68,108)	$ (70,151)	$ (72,256)	$ (74,424)	$ (76,656)	$ (78,956)
Interest Expense	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Benefit (Charge) due to Net Change in Income	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$0.130	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary													
Cash Flow after Tax			$ (3,151,378)	$ 409,239	$ 420,452	$ 403,716	$ 414,163	$ 424,924	$ 436,007	$ 447,423	$ 459,182	$ 471,293	$ 483,768
Accumulated Cash Flow	**$ 6,830,730**	**$0.215**	$ (3,151,378)	$ (2,742,139)	$ (2,321,687)	$ (1,917,971)	$ (1,503,808)	$ (1,078,884)	$ (642,877)	$ (195,453)	$ 263,728	$ 735,022	$ 1,218,789
PV of Cash Flow			$ (3,151,378)	$ 387,904	$ 377,756	$ 343,810	$ 334,320	$ 325,124	$ 316,213	$ 307,575	$ 299,202	$ 291,084	$ 283,212
NPV at 5.5%	**$ 2,562,354**												
Payback Yrs	**7.43**												
IRR	**13.24%**												

	Year 11	Year … 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Costs											
Up-Front Cost/Down Payment											$ (3,151,378)
Annual Cash Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (61,166)	$ (63,001)	$ (64,891)	$ (66,838)	$ (68,843)	$ (70,908)	$ (73,035)	$ (75,226)	$ (77,483)	$ (79,808)	$ (1,170,566)
Maintenance Reserve	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (500,000)
Insurance	$ (20,159)	$ (20,764)	$ (21,386)	$ (22,028)	$ (22,689)	$ (23,370)	$ (24,071)	$ (24,793)	$ (25,536)	$ (26,303)	$ (403,056)
Total Costs	$ (106,325)	$ (108,764)	$ (111,277)	$ (113,866)	$ (116,532)	$ (119,278)	$ (122,106)	$ (125,019)	$ (128,020)	$ (131,110)	$ (5,225,000)
PV of Costs	$ (59,001)	$ (57,208)	$ (55,479)	$ (53,809)	$ (52,198)	$ (50,643)	$ (49,141)	$ (47,691)	$ (46,289)	$ (44,935)	$ (4,324,011)
Benefits											
Utility Escalation Rate	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 522,466	$ 538,140	$ 554,284	$ 570,913	$ 588,040	$ 605,681	$ 623,852	$ 642,567	$ 661,844	$ 681,700	$ 10,446,230
REC (Green Tag) Value ($/kWh)	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0
REC (Green Tag) Value ($)	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 1,609,500
Total Income	$ 602,941	$ 618,615	$ 634,759	$ 651,388	$ 668,515	$ 686,156	$ 704,327	$ 723,042	$ 742,319	$ 762,175	$ 12,055,730
PV of Income	$ 334,578	$ 325,380	$ 316,466	$ 307,826	$ 299,450	$ 291,329	$ 283,454	$ 275,816	$ 268,407	$ 261,219	$ 6,886,365
Income Tax Impact											
Investment Tax Credit											$ -
5-yr MACRS Double Declining Balance Sched.											
Tax Value of MACRS 5-year Depreciation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 602,941	$ 618,615	$ 634,759	$ 651,388	$ 668,515	$ 686,156	$ 704,327	$ 723,042	$ 742,319	$ 762,175	$ 12,055,730
Maintenance + Insurance	$ (81,325)	$ (83,764)	$ (86,277)	$ (88,866)	$ (91,532)	$ (94,278)	$ (97,106)	$ (100,019)	$ (103,020)	$ (106,110)	$ (1,573,622)
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Benefit (Charge) due to Net Change in Income	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary											
Cash Flow after Tax	$ 496,616	$ 509,851	$ 523,482	$ 537,522	$ 551,983	$ 566,879	$ 582,221	$ 598,023	$ 614,300	$ 631,064	$ 6,830,730
Accumulated Cash Flow	$ 1,715,405	$ 2,225,256	$ 2,748,738	$ 3,286,260	$ 3,838,244	$ 4,405,122	$ 4,987,343	$ 5,585,366	$ 6,199,666	$ 6,830,730	$ 6,830,730
PV of Cash Flow	$ 275,578	$ 268,172	$ 260,987	$ 254,016	$ 247,252	$ 240,686	$ 234,313	$ 228,125	$ 222,118	$ 216,284	$ 2,562,354

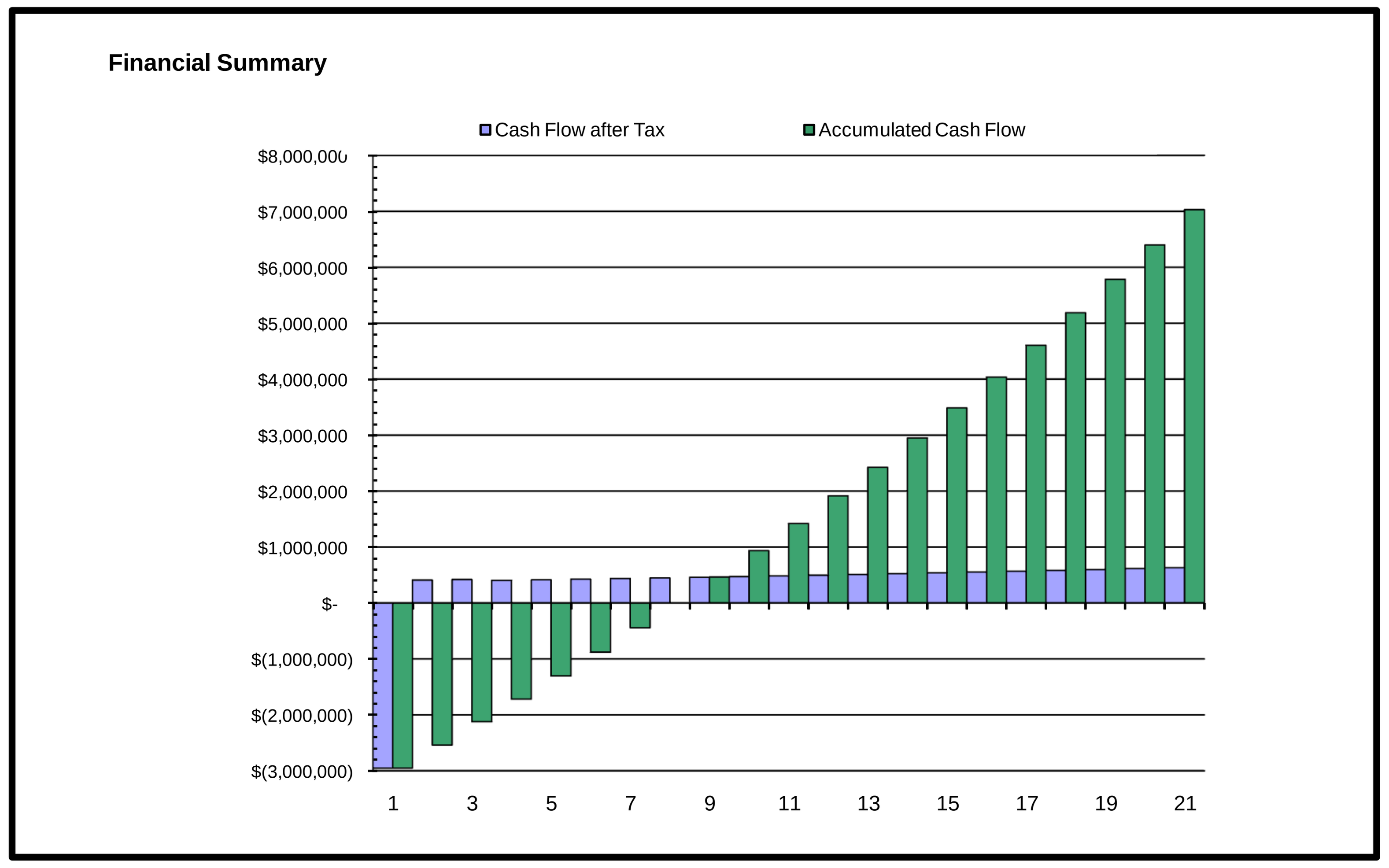
Project Economics Unleveraged With Appropriation and Grant

Contact: Kevin Schulte 585 265 2384
kevin@sed-net.com

SUSTAINABLE ENERGY DEVELOPMENTS INC.

Prepared for: **Udel - Lewes - Site 1 1 x GE SLE 1500kW** **Location: Lewes, DE**

Date: **5/19/2009**



Project Assumptions

Number of Turbines		**1**
Total Installed Capacity (kW)		1,500
Average Wind Speed (m/s)		**6.7**
Wind Speed mph		15.1
Annual Energy Output (kWh)		**4,023,750.0**
Capacity Factor		31%
Maintenance ($/kWh)	$	**0.012**
Annual Maintenance Cost	$	48,285
Escalation Rate		**3.0%**
Annual Maintenance Reserve	$	**25,000**
Annual Insurance Cost	$	**15,000**
Escalation Rate		**3.0%**
Power Purchase Price ($/kWh)	$	**0.094**
Annual Energy Value	$	377,441
Power Purchase Escalator		(enter below)
REC (Green Tag) Value		(enter below)

Cost Summary

Turbine Cost (per turbine)	$	**2,600,000**
Tower Cost (per turbine)	$	**-**
Installation Cost (incl 100K transaction cost	$	**1,718,673**
Development Costs	$	**232,705**
Subtotal	$	**4,551,378**
Earmark + Grant	$	**(1,600,000)**
Earmark + Grant (%)		35%
Net Installed Cost	$	**2,951,378**
Cost/kW	$	1,968

Cash In Summary

Cash In Summary		**0%**
Amount to be Financed		
Cash In Total	$	-
Term of Cash Repayment (years)		
Cash Interest Rate (annual)		
Annual Cash Payback		
Monthly Cash Payback	$	-

Equity Summary

Percentage Equity		
Amount of Debt	$	2,951,378
Amount Equity	$	-
Equity Term (years)		
Equity Interest Rate (annual)		
Annual Equity Payment		#DIV/0!
Monthly Equity Payment		#DIV/0!

Debt Summary

Percentage Debt		**0%**
Remaining Amount	$	2,951,378
Amount of Debt	$	-
Debt Term (years)		**0**
Debt Interest Rate (annual)		**0.0%**
Annual Debt Payment		#DIV/0!
Monthly Debt Payment		#DIV/0!

Tax & Financial Assumptions

Discount Rate (for NPV)		**5.5%**
Customer Tax Rate (State+Fed)		**0.0%**
Investment Tax Credit (%)		**0%**
Investment Tax Credit ($)	$	-
PTC ($/kWh)	$	**-**
PTC Inflation		**0.0%**
PTC Yrs Qualified		**-**

Results

Internal Rate of Return		14.3%
Payback (years)		6.99
NPV at 5.5%	$	**2,762,354**
Lifetime Net Savings	$	7,030,730
Lifetime Energy Output (kWh)		80,475,000
Average Lifetime Cost/kWh of Grid Power	$	0.130
Lifetime Fixed Cost/kWh of Wind Energy	$	0.042

Detailed Project Economics Estimate for Udel - Lewes - Site 1

	Total	Levelized Cost / kWh	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Costs													
Up-Front Cost/Down Payment	(2,951,378)	($0.037)	(2,951,378)										
Annual Cash Payments	-	$0.000		-	-	-	-	-	-	-	-	-	-
Annual Equity Payments	-	$0.000		-	-	-	-	-	-	-	-	-	-
Annual Debt Payments	-	$0.000		-	-	-	-	-	-	-	-	-	-
Maintenance Variable	(1,170,566)	($0.015)		(20,000)	(20,000)	(48,285)	(49,734)	(51,226)	(52,762)	(54,345)	(55,976)	(57,655)	(59,384)
Maintenance Reserve	(500,000)	($0.006)		(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)
Insurance	(403,056)	($0.005)		(15,000)	(15,450)	(15,914)	(16,391)	(16,883)	(17,389)	(17,911)	(18,448)	(19,002)	(19,572)
Total Costs	(5,025,000)	($0.062)	(2,951,378)	(60,000)	(60,450)	(89,199)	(91,124)	(93,108)	(95,151)	(97,256)	(99,424)	(101,656)	(103,956)
PV of Costs	(4,124,011)	($0.051)	(2,951,378)	(56,872)	(54,311)	(75,963)	(73,557)	(71,240)	(69,008)	(66,857)	(64,784)	(62,786)	(60,859)
Benefits													
Utility Escalation Rate				3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	10,446,230	$0.130		388,764	400,427	412,440	424,813	437,557	450,684	464,204	478,130	492,474	507,249
REC (Green Tag) Value ($/kWh)		$0.000		0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
REC (Green Tag) Value ($)	1,609,500	$0.020		80,475	80,475	80,475	80,475	80,475	80,475	80,475	80,475	80,475	80,475
Total Income	12,055,730	$0.150		469,239	480,902	492,915	505,288	518,032	531,159	544,679	558,605	572,949	587,724
PV of Income	6,886,365	$0.086		444,776	432,067	419,773	407,877	396,364	385,221	374,433	363,987	353,870	344,071
Income Tax Impact													
Investment Tax Credit	-		-										
5-yr MACRS Double Declining Balance Sched.			60.00%	16.00%	9.60%	5.76%	5.76%	2.88%					
Tax Value of MACRS 5-year Depreciation	-	$0.000	-	-	-	-	-	-	-	-	-	-	-
Tax Value of Production Tax Credit	-	$0.000		-	-	-	-	-	-	-	-	-	-
Income	12,055,730	$0.150	-	469,239	480,902	492,915	505,288	518,032	531,159	544,679	558,605	572,949	587,724
Maintenance + Insurance	(1,573,622)	($0.020)		(35,000)	(35,450)	(64,199)	(66,124)	(68,108)	(70,151)	(72,256)	(74,424)	(76,656)	(78,956)
Interest Expense	-	$0.000		-	-	-	-	-	-	-	-	-	-
Tax Benefit (Charge) due to Net Change in Income	-	$0.000	-	-	-	-	-	-	-	-	-	-	-
Total Tax Benefit (Charge)	-	$0.130	-	-	-	-	-	-	-	-	-	-	-
PV of Tax Impact	-	$0.000	-	-	-	-	-	-	-	-	-	-	-
Summary													
Cash Flow after Tax			(2,951,378)	409,239	420,452	403,716	414,163	424,924	436,007	447,423	459,182	471,293	483,768
Accumulated Cash Flow	**7,030,730**	**$0.218**	(2,951,378)	(2,542,139)	(2,121,687)	(1,717,971)	(1,303,808)	(878,884)	(442,877)	4,547	463,728	935,022	1,418,789
PV of Cash Flow			(2,951,378)	387,904	377,756	343,810	334,320	325,124	316,213	307,575	299,202	291,084	283,212
NPV at 5.5%	**2,762,354**												
Payback Yrs	6.99												
IRR	14.27%												

	Year 11	Year ... 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Costs											
Up-Front Cost/Down Payment											(2,951,378)
Annual Cash Payments	-	-	-	-	-	-	-	-	-	-	-
Annual Equity Payments	-	-	-	-	-	-	-	-	-	-	-
Annual Debt Payments	-	-	-	-	-	-	-	-	-	-	-
Maintenance Variable	(61,166)	(63,001)	(64,891)	(66,838)	(68,843)	(70,908)	(73,035)	(75,226)	(77,483)	(79,808)	(1,170,566)
Maintenance Reserve	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)	(500,000)
Insurance	(20,159)	(20,764)	(21,386)	(22,028)	(22,689)	(23,370)	(24,071)	(24,793)	(25,536)	(26,303)	(403,056)
Total Costs	(106,325)	(108,764)	(111,277)	(113,866)	(116,532)	(119,278)	(122,106)	(125,019)	(128,020)	(131,110)	(5,025,000)
PV of Costs	(59,001)	(57,208)	(55,479)	(53,809)	(52,198)	(50,643)	(49,141)	(47,691)	(46,289)	(44,935)	(4,124,011)
Benefits											
Utility Escalation Rate	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	522,466	538,140	554,284	570,913	588,040	605,681	623,852	642,567	661,844	681,700	10,446,230
REC (Green Tag) Value ($/kWh)	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0
REC (Green Tag) Value ($)	80,475	80,475	80,475	80,475	80,475	80,475	80,475	80,475	80,475	80,475	1,609,500
Total Income	602,941	618,615	634,759	651,388	668,515	686,156	704,327	723,042	742,319	762,175	12,055,730
PV of Income	334,578	325,380	316,466	307,826	299,450	291,329	283,454	275,816	268,407	261,219	6,886,365
Income Tax Impact											
Investment Tax Credit											-
5-yr MACRS Double Declining Balance Sched.											
Tax Value of MACRS 5-year Depreciation	-	-	-	-	-	-	-	-	-	-	-
Tax Value of Production Tax Credit	-	-	-	-	-	-	-	-	-	-	-
Income	602,941	618,615	634,759	651,388	668,515	686,156	704,327	723,042	742,319	762,175	12,055,730
Maintenance + Insurance	(81,325)	(83,764)	(86,277)	(88,866)	(91,532)	(94,278)	(97,106)	(100,019)	(103,020)	(106,110)	(1,573,622)
Interest Expense	-	-	-	-	-	-	-	-	-	-	-
Tax Benefit (Charge) due to Net Change in Income	-	-	-	-	-	-	-	-	-	-	-
Total Tax Benefit (Charge)	-	-	-	-	-	-	-	-	-	-	-
PV of Tax Impact	-	-	-	-	-	-	-	-	-	-	-
Summary											
Cash Flow after Tax	496,616	509,851	523,482	537,522	551,983	566,879	582,221	598,023	614,300	631,064	7,030,730
Accumulated Cash Flow	1,915,405	2,425,256	2,948,738	3,486,260	4,038,244	4,605,122	5,187,343	5,785,366	6,399,666	7,030,730	7,030,730
PV of Cash Flow	275,578	268,172	260,987	254,016	247,252	240,686	234,313	228,125	222,118	216,284	2,762,354

Project Economics Unleveraged with Appropriation and Net Metering

Contact: Kevin Schulte 585 265 2384
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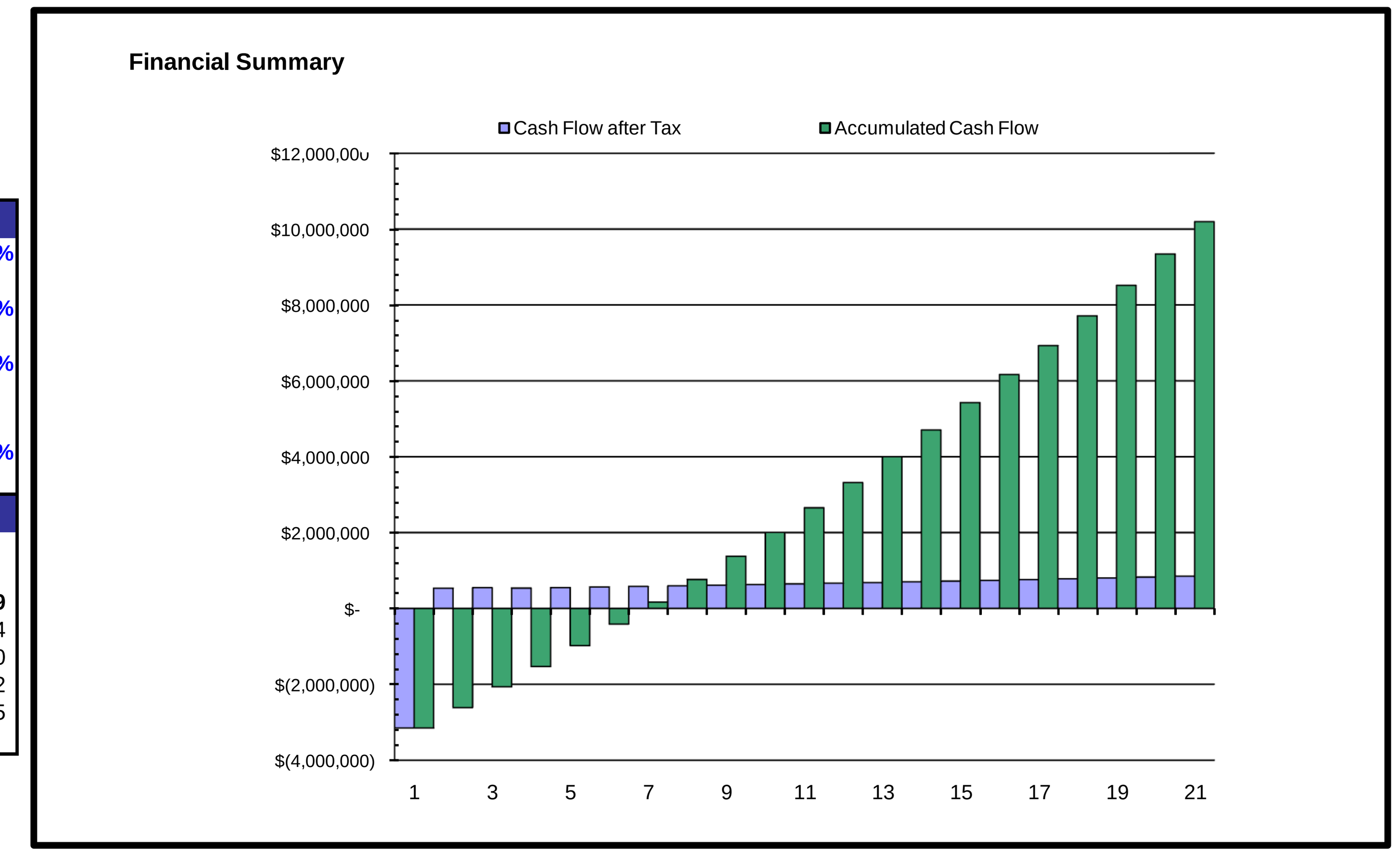
SUSTAINABLE ENERGY DEVELOPMENTS INC.

Prepared for: Udel - Lewes - Site 1 1 x GE SLE 1500kW **Location:** Lewes, DE

Date: 5/19/2009

Project Assumptions		Cost Summary		Equity Summary		Tax & Financial Assumptions	
		Turbine Cost (per turbine)	$ 2,600,000			Discount Rate (for NPV)	5.5%
Number of Turbines	1	Tower Cost (per turbine)	$ -	Percentage Equity			
Total Installed Capacity (kW)	1,500	Installation Cost (incl 100K transaction cost	$ 1,718,673	Amount of Debt	$ 3,151,378	Customer Tax Rate (State+Fed)	0.0%
		Development Costs	$ 232,705	Amount Equity	$ -		
Average Wind Speed (m/s)	6.7	Subtotal	$ 4,554,158	Equity Term (years)		Investment Tax Credit (%)	0%
Wind Speed mph	15.1	Earmark	$ (1,400,000)	Equity Interest Rate (annual)		Investment Tax Credit ($)	$ -
Annual Energy Output (kWh)	4,023,750.0	Earmark (%)	31%	Annual Equity Payment	#DIV/0!	PTC ($/kWh)	$ -
Capacity Factor	31%	**Net Installed Cost**	**$ 3,151,378**	Monthly Equity Payment	#DIV/0!	PTC Inflation	0.0%
Maintenance ($/kWh)	$ 0.012	Cost/kW	$ 2,101			PTC Yrs Qualified	-
Annual Maintenance Cost	$ 48,285	**Cash In Summary**		**Debt Summary**		**Results**	
Escalation Rate	3.0%	Cash In Summary	0%	Percentage Debt	0%	Internal Rate of Return	18.1%
Annual Maintenance Reserve	$ 25,000	Amount to be Financed		Remaining Amount	$ 3,151,378	Payback (years)	5.71
Annual Insurance Cost	$ 15,000	Cash In Total	$ -	Amount of Debt	$ -	NPV at 5.5%	**$ 4,469,599**
Escalation Rate	3.0%	Term of Cash Repayment (years)		Debt Term (years)	0	Lifetime Net Savings	$ 10,193,544
Power Purchase Price ($/kWh)	$ 0.124	Cash Interest Rate (annual)		Debt Interest Rate (annual)	0.0%	Lifetime Energy Output (kWh)	80,475,000
Annual Energy Value	$ 498,945	Annual Cash Payback		Annual Debt Payment	#DIV/0!	Average Lifetime Cost/kWh of Grid Power	$ 0.172
Power Purchase Escalator	(enter below)	Monthly Cash Payback	$ -	Monthly Debt Payment	#DIV/0!	Lifetime Fixed Cost/kWh of Wind Energy	$ 0.045
REC (Green Tag) Value	(enter below)						



Detailed Project Economics Estimate for Udel - Lewes - Site 1

	Total	Levelized Cost / kWh	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Costs													
Up-Front Cost/Down Payment	$ (3,151,378)	($0.039)	$ (3,151,378)										
Annual Cash Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (1,170,566)	($0.015)		$ (20,000)	$ (20,000)	$ (48,285)	$ (49,734)	$ (51,226)	$ (52,762)	$ (54,345)	$ (55,976)	$ (57,655)	$ (59,384)
Maintenance Reserve	$ (500,000)	($0.006)		$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)
Insurance	$ (403,056)	($0.005)		$ (15,000)	$ (15,450)	$ (15,914)	$ (16,391)	$ (16,883)	$ (17,389)	$ (17,911)	$ (18,448)	$ (19,002)	$ (19,572)
Total Costs	$ (5,225,000)	($0.065)	$ (3,151,378)	$ (60,000)	$ (60,450)	$ (89,199)	$ (91,124)	$ (93,108)	$ (95,151)	$ (97,256)	$ (99,424)	$ (101,656)	$ (103,956)
PV of Costs	$ (4,324,011)	($0.054)	$ (3,151,378)	$ (56,872)	$ (54,311)	$ (75,963)	$ (73,557)	$ (71,240)	$ (69,008)	$ (66,857)	$ (64,784)	$ (62,786)	$ (60,859)
Benefits													
Utility Escalation Rate				3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 13,809,044	$0.172		$ 513,913	$ 529,331	$ 545,211	$ 561,567	$ 578,414	$ 595,766	$ 613,639	$ 632,049	$ 651,010	$ 670,540
REC (Green Tag) Value ($/kWh)		$0.000		$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020
REC (Green Tag) Value ($)	$ 1,609,500	$0.020		$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475
Total Income	$ 15,418,544	$0.192		$ 594,388	$ 609,806	$ 625,686	$ 642,042	$ 658,889	$ 676,241	$ 694,114	$ 712,524	$ 731,485	$ 751,015
PV of Income	$ 8,793,610	$0.109		$ 563,401	$ 547,881	$ 532,842	$ 518,267	$ 504,139	$ 490,441	$ 477,160	$ 464,280	$ 451,787	$ 439,667
Income Tax Impact													
Investment Tax Credit	$ -		$ -										
5-yr MACRS Double Declining Balance Sched.			60.00%	16.00%	9.60%	5.76%	5.76%	2.88%					
Tax Value of MACRS 5-year Depreciation	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 15,418,544	$0.192	$ -	$ 594,388	$ 609,806	$ 625,686	$ 642,042	$ 658,889	$ 676,241	$ 694,114	$ 712,524	$ 731,485	$ 751,015
Maintenance + Insurance	$ (1,573,622)	($0.020)		$ (35,000)	$ (35,450)	$ (64,199)	$ (66,124)	$ (68,108)	$ (70,151)	$ (72,256)	$ (74,424)	$ (76,656)	$ (78,956)
Interest Expense	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Benefit (Charge) due to Net Change in Income	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$0.172	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary													
Cash Flow after Tax			$ (3,151,378)	$ 534,388	$ 549,356	$ 536,487	$ 550,918	$ 565,781	$ 581,090	$ 596,858	$ 613,100	$ 629,829	$ 647,059
Accumulated Cash Flow	**$ 10,193,544**	**$0.299**	$ (3,151,378)	$ (2,616,990)	$ (2,067,634)	$ (1,531,147)	$ (980,229)	$ (414,448)	$ 166,642	$ 763,500	$ 1,376,600	$ 2,006,429	$ 2,653,488
PV of Cash Flow			$ (3,151,378)	$ 506,529	$ 493,570	$ 456,880	$ 444,710	$ 432,898	$ 421,433	$ 410,302	$ 399,495	$ 389,001	$ 378,808
NPV at 5.5%	**$ 4,469,599**												
Payback Yrs	**5.71**												
IRR	**18.06%**												

	Year 11	Year ... 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Costs											
Up-Front Cost/Down Payment											$ (3,151,378)
Annual Cash Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (61,166)	$ (63,001)	$ (64,891)	$ (66,838)	$ (68,843)	$ (70,908)	$ (73,035)	$ (75,226)	$ (77,483)	$ (79,808)	$ (1,170,566)
Maintenance Reserve	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (500,000)
Insurance	$ (20,159)	$ (20,764)	$ (21,386)	$ (22,028)	$ (22,689)	$ (23,370)	$ (24,071)	$ (24,793)	$ (25,536)	$ (26,303)	$ (403,056)
Total Costs	$ (106,325)	$ (108,764)	$ (111,277)	$ (113,866)	$ (116,532)	$ (119,278)	$ (122,106)	$ (125,019)	$ (128,020)	$ (131,110)	$ (5,225,000)
PV of Costs	$ (59,001)	$ (57,208)	$ (55,479)	$ (53,809)	$ (52,198)	$ (50,643)	$ (49,141)	$ (47,691)	$ (46,289)	$ (44,935)	$ (4,324,011)
Benefits											
Utility Escalation Rate	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 690,657	$ 711,376	$ 732,718	$ 754,699	$ 777,340	$ 800,660	$ 824,680	$ 849,420	$ 874,903	$ 901,150	$ 13,809,044
REC (Green Tag) Value ($/kWh)	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0
REC (Green Tag) Value ($)	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 1,609,500
Total Income	$ 771,132	$ 791,851	$ 813,193	$ 835,174	$ 857,815	$ 881,135	$ 905,155	$ 929,895	$ 955,378	$ 981,625	$ 15,418,544
PV of Income	$ 427,909	$ 416,499	$ 405,426	$ 394,678	$ 384,244	$ 374,113	$ 364,277	$ 354,723	$ 345,445	$ 336,431	$ 8,793,610
Income Tax Impact											
Investment Tax Credit											$ -
5-yr MACRS Double Declining Balance Sched.											
Tax Value of MACRS 5-year Depreciation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 771,132	$ 791,851	$ 813,193	$ 835,174	$ 857,815	$ 881,135	$ 905,155	$ 929,895	$ 955,378	$ 981,625	$ 15,418,544
Maintenance + Insurance	$ (81,325)	$ (83,764)	$ (86,277)	$ (88,866)	$ (91,532)	$ (94,278)	$ (97,106)	$ (100,019)	$ (103,020)	$ (106,110)	$ (1,573,622)
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Benefit (Charge) due to Net Change in Income	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary											
Cash Flow after Tax	$ 664,807	$ 683,087	$ 701,915	$ 721,308	$ 741,283	$ 761,858	$ 783,049	$ 804,876	$ 827,358	$ 850,515	$ 10,193,544
Accumulated Cash Flow	$ 3,318,295	$ 4,001,382	$ 4,703,297	$ 5,424,605	$ 6,165,888	$ 6,927,746	$ 7,710,795	$ 8,515,671	$ 9,343,030	$ 10,193,544	$ 10,193,544
PV of Cash Flow	$ 368,908	$ 359,291	$ 349,947	$ 340,868	$ 332,045	$ 323,470	$ 315,135	$ 307,033	$ 299,155	$ 291,496	$ 4,469,599

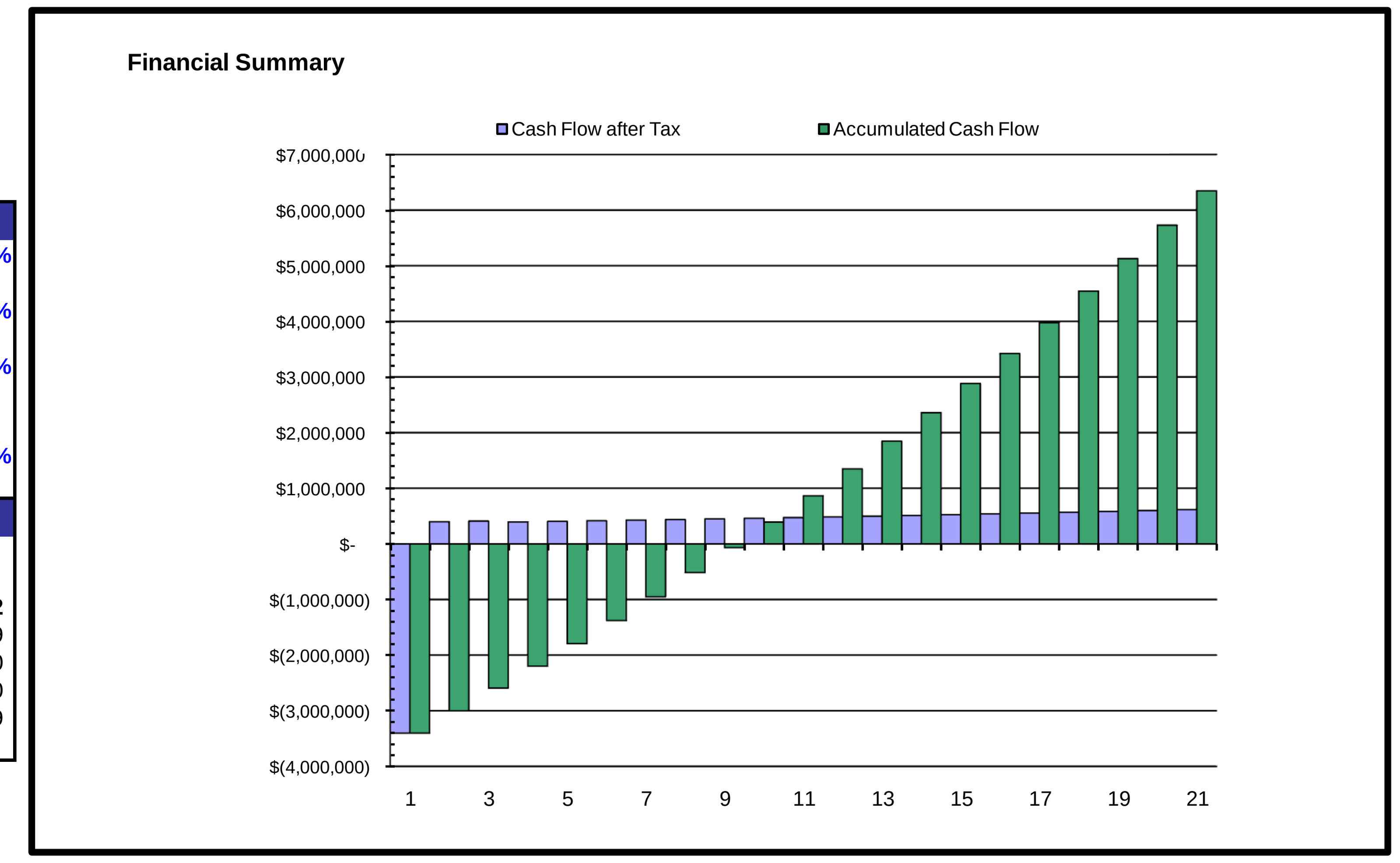
Project Economics - Site 2 Unleveraged with Appropriation

Contact: Kevin Schulte 585 265 2384
kevin@sed-net.com

SUSTAINABLE ENERGY DEVELOPMENTS INC.

Prepared for: Udel - Lewes - Site 2 1 x GE SLE 1500kW **Location:** Lewes, DE

Date: 5/19/2009



Project Assumptions

Number of Turbines		1
Total Installed Capacity (kW)		1,500
Average Wind Speed (m/s)		6.6
Wind Speed mph		14.9
Annual Energy Output (kWh)		3,937,000.0
Capacity Factor		30%
Maintenance ($/kWh)	$	0.012
Annual Maintenance Cost	$	47,244
Escalation Rate		3.0%
Annual Maintenance Reserve	$	25,000
Annual Insurance Cost	$	15,000
Escalation Rate		3.0%
Power Purchase Price ($/kWh)	$	0.094
Annual Energy Value	$	369,303
Power Purchase Escalator	(enter below)	
REC (Green Tag) Value	(enter below)	

Cost Summary

Turbine Cost (per turbine)	$	2,600,000
Tower Cost (per turbine)	$	-
Installation Cost (incl 100K transaction cost	$	1,969,014
Development Costs	$	232,705
Subtotal	$	4,801,719
Earmark	$	(1,400,000)
Earmark (%)		29%
Net Installed Cost	$	**3,401,719**
Cost/kW	$	2,268

Cash In Summary

Cash In Summary		0%
Amount to be Financed		
Cash In Total	$	-
Term of Cash Repayment (years)		
Cash Interest Rate (annual)		
Annual Cash Payback		
Monthly Cash Payback	$	-

Equity Summary

Percentage Equity		
Amount of Debt	$	3,401,719
Amount Equity	$	-
Equity Term (years)		
Equity Interest Rate (annual)		
Annual Equity Payment		#DIV/0!
Monthly Equity Payment		#DIV/0!

Debt Summary

Percentage Debt		0%
Remaining Amount	$	3,401,719
Amount of Debt	$	-
Debt Term (years)		0
Debt Interest Rate (annual)		0.0%
Annual Debt Payment		#DIV/0!
Monthly Debt Payment		#DIV/0!

Tax & Financial Assumptions

Discount Rate (for NPV)		5.5%
Customer Tax Rate (State+Fed)		0.0%
Investment Tax Credit (%)		0%
Investment Tax Credit ($)	$	-
PTC ($/kWh)	$	-
PTC Inflation		0.0%
PTC Yrs Qualified		-

Results

Internal Rate of Return		11.7%
Payback (years)		8.15
NPV at 5.5%	$	**2,176,662**
Lifetime Net Savings	$	6,344,849
Lifetime Energy Output (kWh)		78,740,000
Average Lifetime Cost/kWh of Grid Power	$	0.130
Lifetime Fixed Cost/kWh of Wind Energy	$	0.049

Detailed Project Economics Estimate for Udel - Lewes - Site 2

	Total	Levelized Cost / kWh	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Costs													
Up-Front Cost/Down Payment	$ (3,401,719)	($0.043)	$ (3,401,719)										
Annual Cash Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (1,146,192)	($0.015)		$ (20,000)	$ (20,000)	$ (47,244)	$ (48,661)	$ (50,121)	$ (51,625)	$ (53,174)	$ (54,769)	$ (56,412)	$ (58,104)
Maintenance Reserve	$ (500,000)	($0.006)		$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)
Insurance	$ (403,056)	($0.005)		$ (15,000)	$ (15,450)	$ (15,914)	$ (16,391)	$ (16,883)	$ (17,389)	$ (17,911)	$ (18,448)	$ (19,002)	$ (19,572)
Total Costs	$ (5,450,966)	($0.069)	$ (3,401,719)	$ (60,000)	$ (60,450)	$ (88,158)	$ (90,052)	$ (92,004)	$ (94,014)	$ (96,084)	$ (98,217)	$ (100,413)	$ (102,676)
PV of Costs	$ (4,561,236)	($0.058)	$ (3,401,719)	$ (56,872)	$ (54,311)	$ (75,076)	$ (72,692)	$ (70,395)	$ (68,183)	$ (66,052)	$ (63,998)	$ (62,018)	$ (60,110)
Benefits													
Utility Escalation Rate				3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 10,221,015	$0.130		$ 380,382	$ 391,794	$ 403,548	$ 415,654	$ 428,124	$ 440,967	$ 454,196	$ 467,822	$ 481,857	$ 496,313
REC (Green Tag) Value ($/kWh)		$0.000		$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020
REC (Green Tag) Value ($)	$ 1,574,800	$0.020		$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740
Total Income	$ 11,795,815	$0.150		$ 459,122	$ 470,534	$ 482,288	$ 494,394	$ 506,864	$ 519,707	$ 532,936	$ 546,562	$ 560,597	$ 575,053
PV of Income	$ 6,737,898	$0.086		$ 435,187	$ 422,752	$ 410,723	$ 399,083	$ 387,819	$ 376,916	$ 366,360	$ 356,139	$ 346,241	$ 336,653
Income Tax Impact													
Investment Tax Credit	$ -		$ -										
5-yr MACRS Double Declining Balance Sched.			60.00%	16.00%	9.60%	5.76%	5.76%	2.88%					
Tax Value of MACRS 5-year Depreciation	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 11,795,815	$0.150	$ -	$ 459,122	$ 470,534	$ 482,288	$ 494,394	$ 506,864	$ 519,707	$ 532,936	$ 546,562	$ 560,597	$ 575,053
Maintenance + Insurance	$ (1,549,247)	($0.020)		$ (35,000)	$ (35,450)	$ (63,158)	$ (65,052)	$ (67,004)	$ (69,014)	$ (71,084)	$ (73,217)	$ (75,413)	$ (77,676)
Interest Expense	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Benefit (Charge) due to Net Change in Income	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$0.130	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary													
Cash Flow after Tax			$ (3,401,719)	$ 399,122	$ 410,084	$ 394,130	$ 404,342	$ 414,860	$ 425,693	$ 436,852	$ 448,345	$ 460,184	$ 472,377
Accumulated Cash Flow	**$ 6,344,849**	**$0.211**	$ (3,401,719)	$ (3,002,596)	$ (2,592,513)	$ (2,198,383)	$ (1,794,041)	$ (1,379,181)	$ (953,488)	$ (516,635)	$ (68,290)	$ 391,893	$ 864,270
PV of Cash Flow			$ (3,401,719)	$ 378,315	$ 368,441	$ 335,647	$ 326,391	$ 317,424	$ 308,732	$ 300,308	$ 292,141	$ 284,223	$ 276,544
NPV at 5.5%	**$ 2,176,662**												
Payback Yrs	**8.15**												
IRR	**11.74%**												

	Year 11	Year ... 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Costs											
Up-Front Cost/Down Payment											$ (3,401,719)
Annual Cash Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (59,847)	$ (61,643)	$ (63,492)	$ (65,397)	$ (67,359)	$ (69,379)	$ (71,461)	$ (73,605)	$ (75,813)	$ (78,087)	$ (1,146,192)
Maintenance Reserve	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (500,000)
Insurance	$ (20,159)	$ (20,764)	$ (21,386)	$ (22,028)	$ (22,689)	$ (23,370)	$ (24,071)	$ (24,793)	$ (25,536)	$ (26,303)	$ (403,056)
Total Costs	$ (105,006)	$ (107,406)	$ (109,878)	$ (112,425)	$ (115,047)	$ (117,749)	$ (120,531)	$ (123,397)	$ (126,349)	$ (129,390)	$ (5,450,966)
PV of Costs	$ (58,269)	$ (56,494)	$ (54,781)	$ (53,128)	$ (51,534)	$ (49,994)	$ (48,507)	$ (47,072)	$ (45,685)	$ (44,346)	$ (4,561,236)
Benefits											
Utility Escalation Rate	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 511,202	$ 526,538	$ 542,334	$ 558,604	$ 575,362	$ 592,623	$ 610,402	$ 628,714	$ 647,575	$ 667,003	$ 10,221,015
REC (Green Tag) Value ($/kWh)	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0
REC (Green Tag) Value ($)	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 1,574,800
Total Income	$ 589,942	$ 605,278	$ 621,074	$ 637,344	$ 654,102	$ 671,363	$ 689,142	$ 707,454	$ 726,315	$ 745,743	$ 11,795,815
PV of Income	$ 327,365	$ 318,365	$ 309,643	$ 301,189	$ 292,994	$ 285,048	$ 277,343	$ 269,870	$ 262,620	$ 255,588	$ 6,737,898
Income Tax Impact											
Investment Tax Credit											$ -
5-yr MACRS Double Declining Balance Sched.											
Tax Value of MACRS 5-year Depreciation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 589,942	$ 605,278	$ 621,074	$ 637,344	$ 654,102	$ 671,363	$ 689,142	$ 707,454	$ 726,315	$ 745,743	$ 11,795,815
Maintenance + Insurance	$ (80,006)	$ (82,406)	$ (84,878)	$ (87,425)	$ (90,047)	$ (92,749)	$ (95,531)	$ (98,397)	$ (101,349)	$ (104,390)	$ (1,549,247)
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Benefit (Charge) due to Net Change in Income	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary											
Cash Flow after Tax	$ 484,936	$ 497,872	$ 511,196	$ 524,919	$ 539,055	$ 553,614	$ 568,611	$ 584,057	$ 599,966	$ 616,353	$ 6,344,849
Accumulated Cash Flow	$ 1,349,206	$ 1,847,078	$ 2,358,274	$ 2,883,193	$ 3,422,248	$ 3,975,863	$ 4,544,473	$ 5,128,530	$ 5,728,496	$ 6,344,849	$ 6,344,849
PV of Cash Flow	$ 269,096	$ 261,871	$ 254,862	$ 248,061	$ 241,460	$ 235,054	$ 228,835	$ 222,798	$ 216,935	$ 211,242	$ 2,176,662

Project Economics - Site 2 Unleveraged with Appropriation and Grant

Contact: Kevin Schulte 585 265 2384
kevin@sed-net.com
SUSTAINABLE ENERGY DEVELOPMENTS INC.

Prepared for: Udel - Lewes - Site 2 1 x GE SLE 1500kW **Location:** Lewes, DE

Date: 5/19/2009

Project Assumptions

Number of Turbines		1
Total Installed Capacity (kW)		1,500
Average Wind Speed (m/s)		6.6
Wind Speed mph		14.9
Annual Energy Output (kWh)		3,937,000.0
Capacity Factor		30%
Maintenance ($/kWh)	$	0.012
Annual Maintenance Cost	$	47,244
Escalation Rate		3.0%
Annual Maintenance Reserve	$	25,000
Annual Insurance Cost	$	15,000
Escalation Rate		3.0%
Power Purchase Price ($/kWh)	$	0.094
Annual Energy Value	$	369,303
Power Purchase Escalator	(enter below)	
REC (Green Tag) Value	(enter below)	

Cost Summary

Turbine Cost (per turbine)	$	2,600,000
Tower Cost (per turbine)	$	-
Installation Cost (incl 100K transaction cost	$	1,969,014
Development Costs	$	232,705
Subtotal	$	4,801,719
Earmark + Grant	$	(1,600,000)
Earmark + Grant (%)		33%
Net Installed Cost	$	**3,201,719**
Cost/kW	$	2,134

Cash In Summary

Cash In Summary		0%
Amount to be Financed		
Cash In Total	$	-
Term of Cash Repayment (years)		
Cash Interest Rate (annual)		
Annual Cash Payback		
Monthly Cash Payback	$	-

Equity Summary

Percentage Equity		
Amount of Debt	$	3,201,719
Amount Equity	$	-
Equity Term (years)		
Equity Interest Rate (annual)		
Annual Equity Payment		#DIV/0!
Monthly Equity Payment		#DIV/0!

Debt Summary

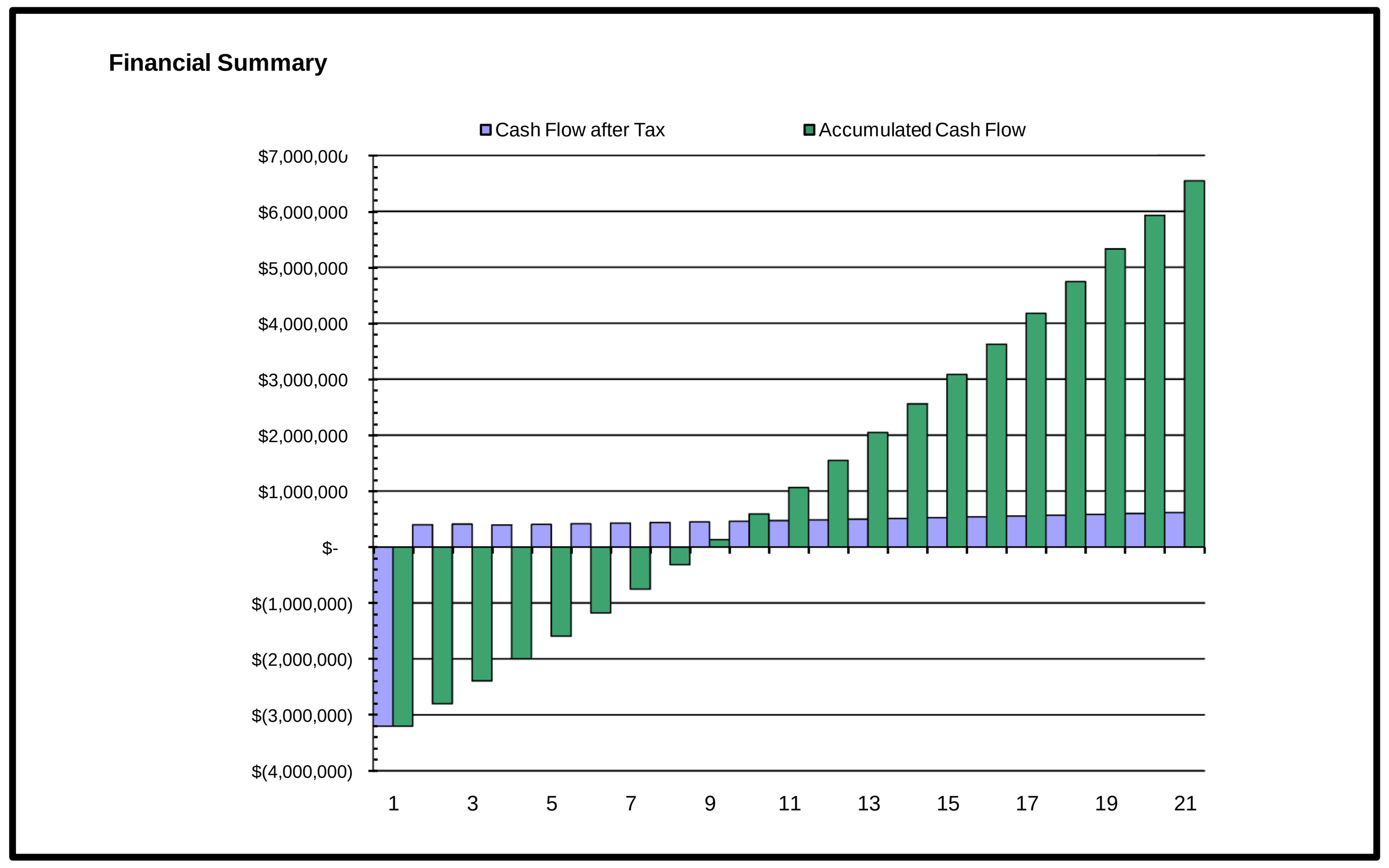
Percentage Debt		0%
Remaining Amount	$	3,201,719
Amount of Debt	$	-
Debt Term (years)		0
Debt Interest Rate (annual)		0.0%
Annual Debt Payment		#DIV/0!
Monthly Debt Payment		#DIV/0!

Tax & Financial Assumptions

Discount Rate (for NPV)		5.5%
Customer Tax Rate (State+Fed)		0.0%
Investment Tax Credit (%)		0%
Investment Tax Credit ($)	$	-
PTC ($/kWh)	$	-
PTC Inflation		0.0%
PTC Yrs Qualified		-

Results

Internal Rate of Return		12.6%
Payback (years)		7.71
NPV at 5.5%	$	**2,376,662**
Lifetime Net Savings	$	6,544,849
Lifetime Energy Output (kWh)		78,740,000
Average Lifetime Cost/kWh of Grid Power	$	0.130
Lifetime Fixed Cost/kWh of Wind Energy	$	0.047



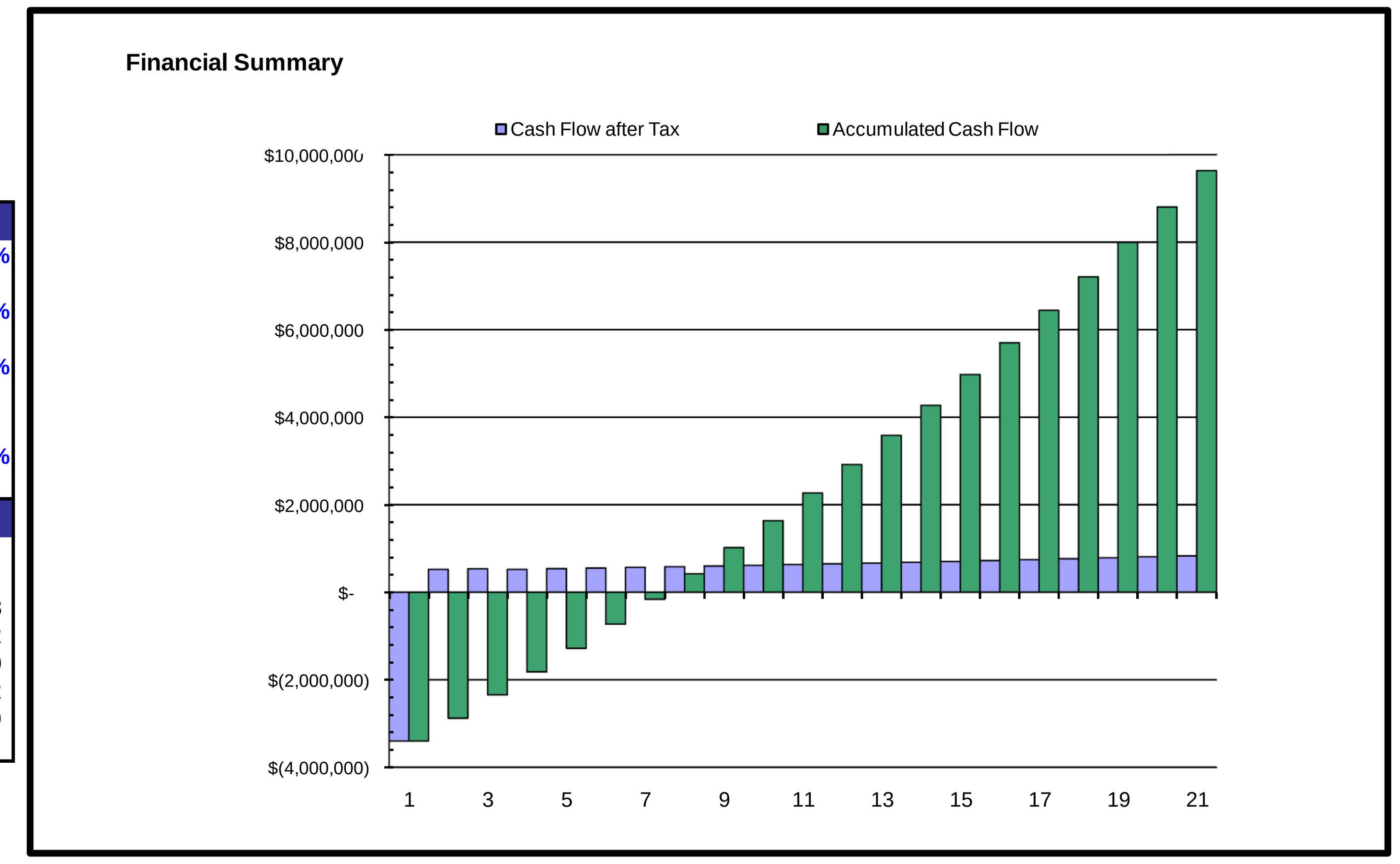
Detailed Project Economics Estimate for Udel - Lewes - Site 2

	Total	Levelized Cost / kWh	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year … 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Costs																								
Up-Front Cost/Down Payment	$ (3,201,719)	($0.041)	$ (3,201,719)																					$ (3,201,719)
Annual Cash Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (1,146,192)	($0.015)		$ (20,000)	$ (20,000)	$ (47,244)	$ (48,661)	$ (50,121)	$ (51,625)	$ (53,174)	$ (54,769)	$ (56,412)	$ (58,104)	$ (59,847)	$ (61,643)	$ (63,492)	$ (65,397)	$ (67,359)	$ (69,379)	$ (71,461)	$ (73,605)	$ (75,813)	$ (78,087)	$ (1,146,192)
Maintenance Reserve	$ (500,000)	($0.006)		$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (500,000)
Insurance	$ (403,056)	($0.005)		$ (15,000)	$ (15,450)	$ (15,914)	$ (16,391)	$ (16,883)	$ (17,389)	$ (17,911)	$ (18,448)	$ (19,002)	$ (19,572)	$ (20,159)	$ (20,764)	$ (21,386)	$ (22,028)	$ (22,689)	$ (23,370)	$ (24,071)	$ (24,793)	$ (25,536)	$ (26,303)	$ (403,056)
Total Costs	$ (5,250,966)	($0.067)	$ (3,201,719)	$ (60,000)	$ (60,450)	$ (88,158)	$ (90,052)	$ (92,004)	$ (94,014)	$ (96,084)	$ (98,217)	$ (100,413)	$ (102,676)	$ (105,006)	$ (107,406)	$ (109,878)	$ (112,425)	$ (115,047)	$ (117,749)	$ (120,531)	$ (123,397)	$ (126,349)	$ (129,390)	$ (5,250,966)
PV of Costs	$ (4,361,236)	($0.055)	$ (3,201,719)	$ (56,872)	$ (54,311)	$ (75,076)	$ (72,692)	$ (70,395)	$ (68,183)	$ (66,052)	$ (63,998)	$ (62,018)	$ (60,110)	$ (58,269)	$ (56,494)	$ (54,781)	$ (53,128)	$ (51,534)	$ (49,994)	$ (48,507)	$ (47,072)	$ (45,685)	$ (44,346)	$ (4,361,236)
Benefits																								
Utility Escalation Rate				3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 10,221,015	$0.130		$ 380,382	$ 391,794	$ 403,548	$ 415,654	$ 428,124	$ 440,967	$ 454,196	$ 467,822	$ 481,857	$ 496,313	$ 511,202	$ 526,538	$ 542,334	$ 558,604	$ 575,362	$ 592,623	$ 610,402	$ 628,714	$ 647,575	$ 667,003	$ 10,221,015
REC (Green Tag) Value ($/kWh)		$0.000		$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0
REC (Green Tag) Value ($)	$ 1,574,800	$0.020		$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 1,574,800
Total Income	$ 11,795,815	$0.150		$ 459,122	$ 470,534	$ 482,288	$ 494,394	$ 506,864	$ 519,707	$ 532,936	$ 546,562	$ 560,597	$ 575,053	$ 589,942	$ 605,278	$ 621,074	$ 637,344	$ 654,102	$ 671,363	$ 689,142	$ 707,454	$ 726,315	$ 745,743	$ 11,795,815
PV of Income	$ 6,737,898	$0.086		$ 435,187	$ 422,752	$ 410,723	$ 399,083	$ 387,819	$ 376,916	$ 366,360	$ 356,139	$ 346,241	$ 336,653	$ 327,365	$ 318,365	$ 309,643	$ 301,189	$ 292,994	$ 285,048	$ 277,343	$ 269,870	$ 262,620	$ 255,588	$ 6,737,898
Income Tax Impact																								
Investment Tax Credit	$ -		$ -																					$ -
5-yr MACRS Double Declining Balance Sched.			60.00%	16.00%	9.60%	5.76%	5.76%	2.88%																
Tax Value of MACRS 5-year Depreciation	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 11,795,815	$0.150	$ -	$ 459,122	$ 470,534	$ 482,288	$ 494,394	$ 506,864	$ 519,707	$ 532,936	$ 546,562	$ 560,597	$ 575,053	$ 589,942	$ 605,278	$ 621,074	$ 637,344	$ 654,102	$ 671,363	$ 689,142	$ 707,454	$ 726,315	$ 745,743	$ 11,795,815
Maintenance + Insurance	$ (1,549,247)	($0.020)		$ (35,000)	$ (35,450)	$ (63,158)	$ (65,052)	$ (67,004)	$ (69,014)	$ (71,084)	$ (73,217)	$ (75,413)	$ (77,676)	$ (80,006)	$ (82,406)	$ (84,878)	$ (87,425)	$ (90,047)	$ (92,749)	$ (95,531)	$ (98,397)	$ (101,349)	$ (104,390)	$ (1,549,247)
Interest Expense	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Benefit (Charge) due to Net Change in Income	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$0.130	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary																								
Cash Flow after Tax			$ (3,201,719)	$ 399,122	$ 410,084	$ 394,130	$ 404,342	$ 414,860	$ 425,693	$ 436,852	$ 448,345	$ 460,184	$ 472,377	$ 484,936	$ 497,872	$ 511,196	$ 524,919	$ 539,055	$ 553,614	$ 568,611	$ 584,057	$ 599,966	$ 616,353	$ 6,544,849
Accumulated Cash Flow	**$ 6,544,849**	**$0.213**	$ (3,201,719)	$ (2,802,596)	$ (2,392,513)	$ (1,998,383)	$ (1,594,041)	$ (1,179,181)	$ (753,488)	$ (316,635)	$ 131,710	$ 591,893	$ 1,064,270	$ 1,549,206	$ 2,047,078	$ 2,558,274	$ 3,083,193	$ 3,622,248	$ 4,175,863	$ 4,744,473	$ 5,328,530	$ 5,928,496	$ 6,544,849	$ 6,544,849
PV of Cash Flow			$ (3,201,719)	$ 378,315	$ 368,441	$ 335,647	$ 326,391	$ 317,424	$ 308,732	$ 300,308	$ 292,141	$ 284,223	$ 276,544	$ 269,096	$ 261,871	$ 254,862	$ 248,061	$ 241,460	$ 235,054	$ 228,835	$ 222,798	$ 216,935	$ 211,242	$ 2,376,662
NPV at 5.5%	**$ 2,376,662**																							
Payback Yrs	7.71																							
IRR	12.63%																							

Project Economics - Site 2 with Appropriation and Net Met Metering

Contact: Kevin Schulte 585 265 2384
kevin@sed-net.com
SUSTAINABLE ENERGY DEVELOPMENTS INC.

Prepared for: Udel - Lewes - Site 2 1 x GE SLE 1500kW **Location:** Lewes, DE
Date: 5/19/2009



Project Assumptions

Number of Turbines		1
Total Installed Capacity (kW)		1,500
Average Wind Speed (m/s)		6.6
Wind Speed mph		14.9
Annual Energy Output (kWh)		3,937,000.0
Capacity Factor		30%
Maintenance ($/kWh)	$	0.012
Annual Maintenance Cost	$	47,244
Escalation Rate		3.0%
Annual Maintenance Reserve	$	25,000
Annual Insurance Cost	$	15,000
Escalation Rate		3.0%
Power Purchase Price ($/kWh)	$	0.124
Annual Energy Value	$	488,188
Power Purchase Escalator	(enter below)	
REC (Green Tag) Value	(enter below)	

Cost Summary

Turbine Cost (per turbine)	$	2,600,000
Tower Cost (per turbine)	$	-
Installation Cost (incl 100K transaction cost	$	1,969,014
Development Costs	$	232,705
Subtotal	$	4,804,499
Earmark	$	(1,400,000)
Earmark (%)		29%
Net Installed Cost	$	**3,401,719**
Cost/kW	$	2,268

Cash In Summary

Cash In Summary		0%
Amount to be Financed		
Cash In Total	$	-
Term of Cash Repayment (years)		
Cash Interest Rate (annual)		
Annual Cash Payback		
Monthly Cash Payback	$	-

Equity Summary

Percentage Equity		
Amount of Debt	$	3,401,719
Amount Equity	$	-
Equity Term (years)		
Equity Interest Rate (annual)		
Annual Equity Payment		#DIV/0!
Monthly Equity Payment		#DIV/0!

Debt Summary

Percentage Debt		0%
Remaining Amount	$	3,401,719
Amount of Debt	$	-
Debt Term (years)		0
Debt Interest Rate (annual)		0.0%
Annual Debt Payment		#DIV/0!
Monthly Debt Payment		#DIV/0!

Tax & Financial Assumptions

Discount Rate (for NPV)		5.5%
Customer Tax Rate (State+Fed)		0.0%
Investment Tax Credit (%)		0%
Investment Tax Credit ($)	$	-
PTC ($/kWh)	$	-
PTC Inflation		0.0%
PTC Yrs Qualified		-

Results

Internal Rate of Return		16.3%
Payback (years)		6.28
NPV at 5.5%	$	**4,042,788**
Lifetime Net Savings	$	9,635,162
Lifetime Energy Output (kWh)		78,740,000
Average Lifetime Cost/kWh of Grid Power	$	0.172
Lifetime Fixed Cost/kWh of Wind Energy	$	0.049

Detailed Project Economics Estimate for Udel - Lewes - Site 2

	Total	Levelized Cost / kWh	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Costs													
Up-Front Cost/Down Payment	$ (3,401,719)	($0.043)	$ (3,401,719)										
Annual Cash Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (1,146,192)	($0.015)		$ (20,000)	$ (20,000)	$ (47,244)	$ (48,661)	$ (50,121)	$ (51,625)	$ (53,174)	$ (54,769)	$ (56,412)	$ (58,104)
Maintenance Reserve	$ (500,000)	($0.006)		$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)
Insurance	$ (403,056)	($0.005)		$ (15,000)	$ (15,450)	$ (15,914)	$ (16,391)	$ (16,883)	$ (17,389)	$ (17,911)	$ (18,448)	$ (19,002)	$ (19,572)
Total Costs	$ (5,450,966)	($0.069)	$ (3,401,719)	$ (60,000)	$ (60,450)	$ (88,158)	$ (90,052)	$ (92,004)	$ (94,014)	$ (96,084)	$ (98,217)	$ (100,413)	$ (102,676)
PV of Costs	$ (4,561,236)	($0.058)	$ (3,401,719)	$ (56,872)	$ (54,311)	$ (75,076)	$ (72,692)	$ (70,395)	$ (68,183)	$ (66,052)	$ (63,998)	$ (62,018)	$ (60,110)
Benefits													
Utility Escalation Rate				3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 13,511,328	$0.172		$ 502,834	$ 517,919	$ 533,456	$ 549,460	$ 565,944	$ 582,922	$ 600,410	$ 618,422	$ 636,975	$ 656,084
REC (Green Tag) Value ($/kWh)		$0.000		$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020
REC (Green Tag) Value ($)	$ 1,574,800	$0.020		$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740
Total Income	$ 15,086,128	$0.192		$ 581,574	$ 596,659	$ 612,196	$ 628,200	$ 644,684	$ 661,662	$ 679,150	$ 697,162	$ 715,715	$ 734,824
PV of Income	$ 8,604,024	$0.109		$ 551,255	$ 536,069	$ 521,355	$ 507,093	$ 493,270	$ 479,868	$ 466,872	$ 454,270	$ 442,046	$ 430,188
Income Tax Impact													
Investment Tax Credit	$ -		$ -										
5-yr MACRS Double Declining Balance Sched.			60.00%	16.00%	9.60%	5.76%	5.76%	2.88%					
Tax Value of MACRS 5-year Depreciation	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 15,086,128	$0.192	$ -	$ 581,574	$ 596,659	$ 612,196	$ 628,200	$ 644,684	$ 661,662	$ 679,150	$ 697,162	$ 715,715	$ 734,824
Maintenance + Insurance	$ (1,549,247)	($0.020)		$ (35,000)	$ (35,450)	$ (63,158)	$ (65,052)	$ (67,004)	$ (69,014)	$ (71,084)	$ (73,217)	$ (75,413)	$ (77,676)
Interest Expense	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Benefit (Charge) due to Net Change in Income	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$0.172	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary													
Cash Flow after Tax			$ (3,401,719)	$ 521,574	$ 536,209	$ 524,039	$ 538,148	$ 552,680	$ 567,648	$ 583,065	$ 598,945	$ 615,301	$ 632,148
Accumulated Cash Flow	**$ 9,635,162**	**$0.294**	$ (3,401,719)	$ (2,880,145)	$ (2,343,936)	$ (1,819,898)	$ (1,281,750)	$ (729,070)	$ (161,422)	$ 421,643	$ 1,020,588	$ 1,635,890	$ 2,268,038
PV of Cash Flow			$ (3,401,719)	$ 494,383	$ 481,758	$ 446,279	$ 434,402	$ 422,874	$ 411,684	$ 400,821	$ 390,272	$ 380,028	$ 370,079
NPV at 5.5%	**$ 4,042,788**												
Payback Yrs	**6.28**												
IRR	**16.26%**												

	Year 11	Year … 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Costs											
Up-Front Cost/Down Payment											$ (3,401,719)
Annual Cash Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (59,847)	$ (61,643)	$ (63,492)	$ (65,397)	$ (67,359)	$ (69,379)	$ (71,461)	$ (73,605)	$ (75,813)	$ (78,087)	$ (1,146,192)
Maintenance Reserve	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (500,000)
Insurance	$ (20,159)	$ (20,764)	$ (21,386)	$ (22,028)	$ (22,689)	$ (23,370)	$ (24,071)	$ (24,793)	$ (25,536)	$ (26,303)	$ (403,056)
Total Costs	$ (105,006)	$ (107,406)	$ (109,878)	$ (112,425)	$ (115,047)	$ (117,749)	$ (120,531)	$ (123,397)	$ (126,349)	$ (129,390)	$ (5,450,966)
PV of Costs	$ (58,269)	$ (56,494)	$ (54,781)	$ (53,128)	$ (51,534)	$ (49,994)	$ (48,507)	$ (47,072)	$ (45,685)	$ (44,346)	$ (4,561,236)
Benefits											
Utility Escalation Rate	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 675,766	$ 696,039	$ 716,921	$ 738,428	$ 760,581	$ 783,398	$ 806,900	$ 831,107	$ 856,041	$ 881,722	$ 13,511,328
REC (Green Tag) Value ($/kWh)	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0
REC (Green Tag) Value ($)	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 78,740	$ 1,574,800
Total Income	$ 754,506	$ 774,779	$ 795,661	$ 817,168	$ 839,321	$ 862,138	$ 885,640	$ 909,847	$ 934,781	$ 960,462	$ 15,086,128
PV of Income	$ 418,684	$ 407,520	$ 396,685	$ 386,169	$ 375,960	$ 366,048	$ 356,423	$ 347,076	$ 337,997	$ 329,178	$ 8,604,024
Income Tax Impact											
Investment Tax Credit											$ -
5-yr MACRS Double Declining Balance Sched.											
Tax Value of MACRS 5-year Depreciation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 754,506	$ 774,779	$ 795,661	$ 817,168	$ 839,321	$ 862,138	$ 885,640	$ 909,847	$ 934,781	$ 960,462	$ 15,086,128
Maintenance + Insurance	$ (80,006)	$ (82,406)	$ (84,878)	$ (87,425)	$ (90,047)	$ (92,749)	$ (95,531)	$ (98,397)	$ (101,349)	$ (104,390)	$ (1,549,247)
Interest Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Benefit (Charge) due to Net Change in Income	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary											
Cash Flow after Tax	$ 649,500	$ 667,373	$ 685,782	$ 704,743	$ 724,274	$ 744,390	$ 765,109	$ 786,450	$ 808,431	$ 831,072	$ 9,635,162
Accumulated Cash Flow	$ 2,917,538	$ 3,584,911	$ 4,270,693	$ 4,975,437	$ 5,699,710	$ 6,444,100	$ 7,209,209	$ 7,995,659	$ 8,804,090	$ 9,635,162	$ 9,635,162
PV of Cash Flow	$ 360,415	$ 351,026	$ 341,904	$ 333,040	$ 324,426	$ 316,054	$ 307,915	$ 300,004	$ 292,312	$ 284,832	$ 4,042,788

APPENDIX E

Financial Model Output Sheets – Baseline Scenarios for Location 1

Project Economics Bonded with Appropriation

Contact: Kevin Schulte 585 265 2384
kevin@sed-net.com
SUSTAINABLE ENERGY DEVELOPMENTS INC.

Prepared for: Udel - Lewes - Site 1 1 x GE SLE 1500kW **Location:** Lewes, DE
Date: 5/19/2009

Project Assumptions

Number of Turbines		1
Total Installed Capacity (kW)		1,500
Average Wind Speed (m/s)		6.7
Wind Speed mph		15.1
Annual Energy Output (kWh)		4,023,750.0
Capacity Factor		31%
Maintenance ($/kWh)	$	0.012
Annual Maintenance Cost	$	48,285
Escalation Rate		3.0%
Annual Maintenance Reserve	$	25,000
Annual Insurance Cost	$	15,000
Escalation Rate		3.0%
Power Purchase Price ($/kWh)	$	0.094
Annual Energy Value	$	377,441
Power Purchase Escalator	(enter below)	
REC (Green Tag) Value	(enter below)	

Cost Summary

Turbine Cost (per turbine)	$	2,600,000
Tower Cost (per turbine)	$	-
Installation Cost (incl 100K transaction cost	$	1,718,673
Development Costs	$	232,705
Subtotal	$	4,551,378
Earmark	$	(1,400,000)
Earmark (%)		31%
Net Installed Cost	$	**3,151,378**
Cost/kW	$	2,101

Cash In Summary

Cash In Summary		0%
Amount to be Financed		
Cash In Total	$	-
Term of Cash Repayment (years)		
Cash Interest Rate (annual)		
Annual Cash Payback		
Monthly Cash Payback	$	-

Equity Summary

Percentage Equity		
Amount of Debt	$	3,151,378
Amount Equity	$	-
Equity Term (years)		
Equity Interest Rate (annual)		
Annual Equity Payment		#DIV/0!
Monthly Equity Payment		#DIV/0!

Debt Summary

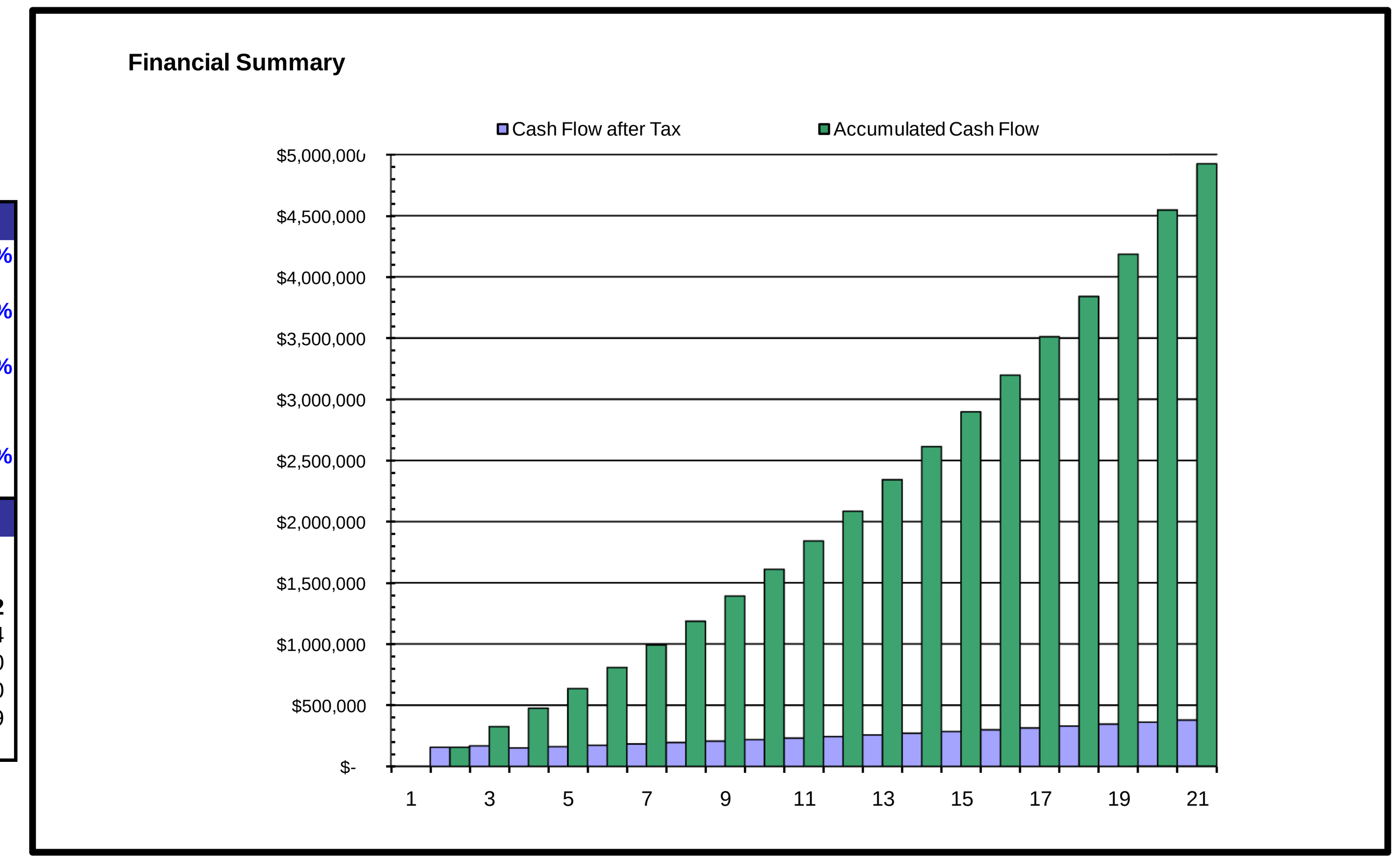
Percentage Debt		100%
Remaining Amount	$	-
Amount of Debt	$	3,151,378
Debt Term (years)		20
Debt Interest Rate (annual)		5.0%
Annual Debt Payment	$	252,875
Monthly Debt Payment	$	21,073

Tax & Financial Assumptions

Discount Rate (for NPV)		5.5%
Customer Tax Rate (State+Fed)		0.0%
Investment Tax Credit (%)		0%
Investment Tax Credit ($)	$	-
PTC ($/kWh)	$	-
PTC Inflation		0.0%
PTC Yrs Qualified		-

Results

Internal Rate of Return		#DIV/0!
Payback (years)		0.00
NPV at 5.5%	$	**2,691,782**
Lifetime Net Savings	$	4,924,614
Lifetime Energy Output (kWh)		80,475,000
Average Lifetime Cost/kWh of Grid Power	$	0.130
Lifetime Fixed Cost/kWh of Wind Energy	$	0.069



Detailed Project Economics Estimate for Udel - Lewes - Site 1

	Total	Levelized Cost / kWh	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year … 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Costs																								
Up-Front Cost/Down Payment	$ -	$0.000	$ -																					$ -
Annual Cash Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ (5,057,495)	($0.063)		$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (252,875)	$ (5,057,495)
Maintenance Variable	$ (1,170,566)	($0.015)		$ (20,000)	$ (20,000)	$ (48,285)	$ (49,734)	$ (51,226)	$ (52,762)	$ (54,345)	$ (55,976)	$ (57,655)	$ (59,384)	$ (61,166)	$ (63,001)	$ (64,891)	$ (66,838)	$ (68,843)	$ (70,908)	$ (73,035)	$ (75,226)	$ (77,483)	$ (79,808)	$ (1,170,566)
Maintenance Reserve	$ (500,000)	($0.006)		$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (500,000)
Insurance	$ (403,056)	($0.005)		$ (15,000)	$ (15,450)	$ (15,914)	$ (16,391)	$ (16,883)	$ (17,389)	$ (17,911)	$ (18,448)	$ (19,002)	$ (19,572)	$ (20,159)	$ (20,764)	$ (21,386)	$ (22,028)	$ (22,689)	$ (23,370)	$ (24,071)	$ (24,793)	$ (25,536)	$ (26,303)	$ (403,056)
Total Costs	$ (7,131,116)	($0.089)	$ -	$ (312,875)	$ (313,325)	$ (342,073)	$ (343,999)	$ (345,983)	$ (348,026)	$ (350,131)	$ (352,298)	$ (354,531)	$ (356,831)	$ (359,199)	$ (361,639)	$ (364,152)	$ (366,740)	$ (369,406)	$ (372,152)	$ (374,981)	$ (377,894)	$ (380,894)	$ (383,985)	$ (7,131,116)
PV of Costs	$ (4,194,583)	($0.052)	$ -	$ (296,564)	$ (281,507)	$ (291,314)	$ (277,682)	$ (264,723)	$ (252,405)	$ (240,693)	$ (229,557)	$ (218,969)	$ (208,900)	$ (199,324)	$ (190,216)	$ (181,552)	$ (173,310)	$ (165,469)	$ (158,009)	$ (150,910)	$ (144,154)	$ (137,723)	$ (131,603)	$ (4,194,583)
Benefits																								
Utility Escalation Rate				3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 10,446,230	$0.130		$ 388,764	$ 400,427	$ 412,440	$ 424,813	$ 437,557	$ 450,684	$ 464,204	$ 478,130	$ 492,474	$ 507,249	$ 522,466	$ 538,140	$ 554,284	$ 570,913	$ 588,040	$ 605,681	$ 623,852	$ 642,567	$ 661,844	$ 681,700	$ 10,446,230
REC (Green Tag) Value ($/kWh)		$0.000		$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0
REC (Green Tag) Value ($)	$ 1,609,500	$0.020		$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 1,609,500
Total Income	$ 12,055,730	$0.150		$ 469,239	$ 480,902	$ 492,915	$ 505,288	$ 518,032	$ 531,159	$ 544,679	$ 558,605	$ 572,949	$ 587,724	$ 602,941	$ 618,615	$ 634,759	$ 651,388	$ 668,515	$ 686,156	$ 704,327	$ 723,042	$ 742,319	$ 762,175	$ 12,055,730
PV of Income	$ 6,886,365	$0.086		$ 444,776	$ 432,067	$ 419,773	$ 407,877	$ 396,364	$ 385,221	$ 374,433	$ 363,987	$ 353,870	$ 344,071	$ 334,578	$ 325,380	$ 316,466	$ 307,826	$ 299,450	$ 291,329	$ 283,454	$ 275,816	$ 268,407	$ 261,219	$ 6,886,365
Income Tax Impact																								
Investment Tax Credit	$ -		$ -																					$ -
5-yr MACRS Double Declining Balance Sched.			60.00%	16.00%	9.60%	5.76%	5.76%	2.88%																
Tax Value of MACRS 5-year Depreciation	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 12,055,730	$0.150	$ -	$ 469,239	$ 480,902	$ 492,915	$ 505,288	$ 518,032	$ 531,159	$ 544,679	$ 558,605	$ 572,949	$ 587,724	$ 602,941	$ 618,615	$ 634,759	$ 651,388	$ 668,515	$ 686,156	$ 704,327	$ 723,042	$ 742,319	$ 762,175	$ 12,055,730
Maintenance + Insurance	$ (1,573,622)	($0.020)		$ (35,000)	$ (35,450)	$ (64,199)	$ (66,124)	$ (68,108)	$ (70,151)	$ (72,256)	$ (74,424)	$ (76,656)	$ (78,956)	$ (81,325)	$ (83,764)	$ (86,277)	$ (88,866)	$ (91,532)	$ (94,278)	$ (97,106)	$ (100,019)	$ (103,020)	$ (106,110)	$ (1,573,622)
Interest Expense	$ (1,906,117)	($0.024)		$ (157,569)	$ (152,804)	$ (147,800)	$ (142,546)	$ (137,030)	$ (131,238)	$ (125,156)	$ (118,770)	$ (112,065)	$ (105,024)	$ (97,632)	$ (89,869)	$ (81,719)	$ (73,161)	$ (64,176)	$ (54,741)	$ (44,834)	$ (34,432)	$ (23,510)	$ (12,042)	$ (1,906,117)
Tax Benefit (Charge) due to Net Change in Income	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$0.107	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary																								
Cash Flow after Tax			$ -	$ 156,364	$ 167,577	$ 150,841	$ 161,289	$ 172,049	$ 183,133	$ 194,549	$ 206,307	$ 218,418	$ 230,893	$ 243,742	$ 256,976	$ 270,607	$ 284,647	$ 299,109	$ 314,004	$ 329,346	$ 345,149	$ 361,425	$ 378,190	$ 4,924,614
Accumulated Cash Flow	**$ 4,924,614**	**$0.168**	$ -	$ 156,364	$ 323,941	$ 474,782	$ 636,071	$ 808,120	$ 991,253	$ 1,185,802	$ 1,392,109	$ 1,610,527	$ 1,841,420	$ 2,085,162	$ 2,342,137	$ 2,612,745	$ 2,897,392	$ 3,196,501	$ 3,510,505	$ 3,839,851	$ 4,184,999	$ 4,546,424	$ 4,924,614	$ 4,924,614
PV of Cash Flow			$ -	$ 148,212	$ 150,560	$ 128,459	$ 130,195	$ 131,641	$ 132,816	$ 133,740	$ 134,429	$ 134,902	$ 135,172	$ 135,255	$ 135,165	$ 134,914	$ 134,516	$ 133,981	$ 133,320	$ 132,544	$ 131,662	$ 130,684	$ 129,617	$ 2,691,782
NPV at 5.5%	**$ 2,691,782**																							
Payback Yrs	0.00																							
IRR	#DIV/0!																							

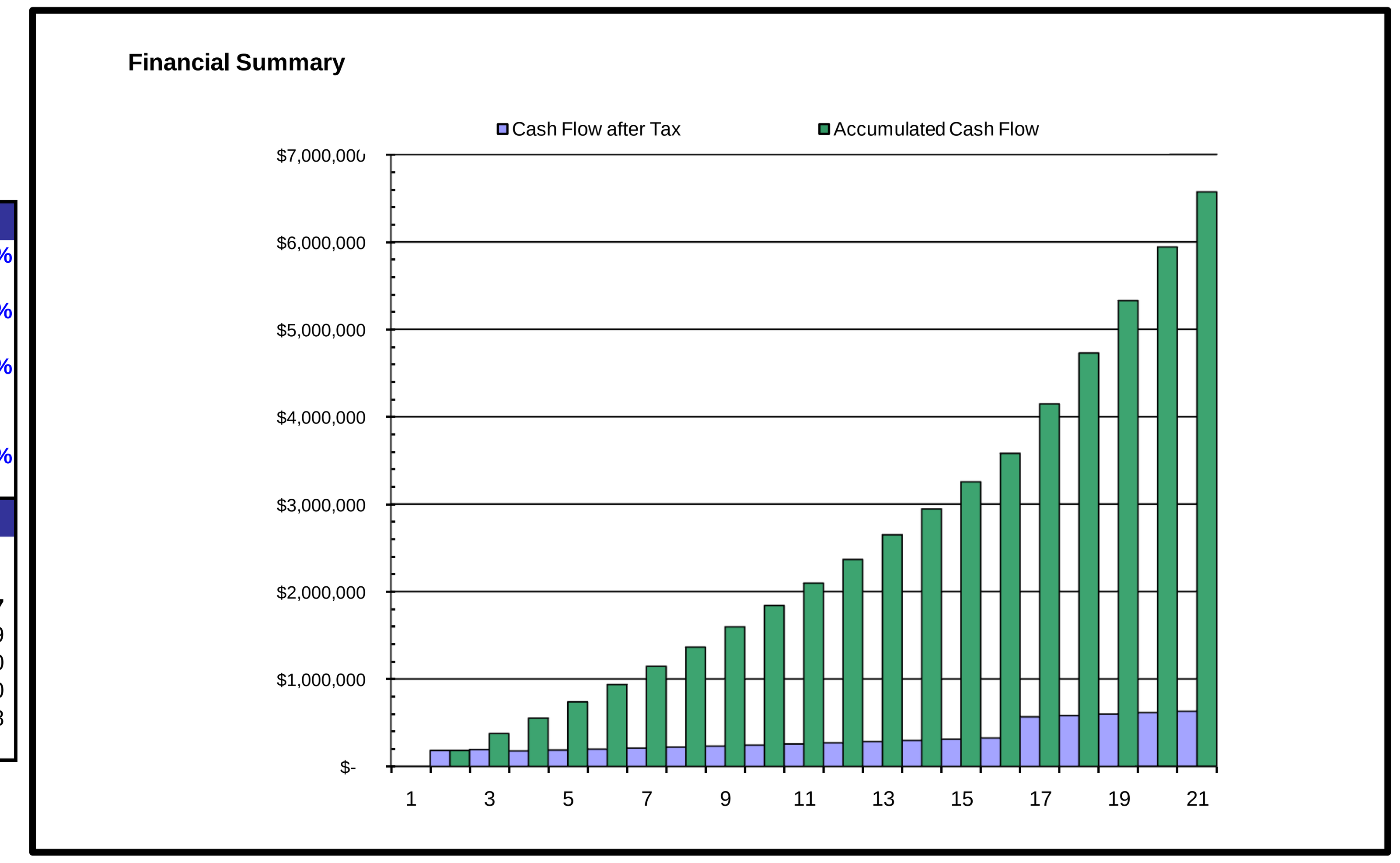
Project Economics CREBS With Appropriation

Contact: Kevin Schulte 585 265 2384
kevin@sed-net.com

SUSTAINABLE ENERGY DEVELOPMENTS INC.

Prepared for: Udel - Lewes - Site 1 1 x GE SLE 1500kW **Location:** Lewes, DE

Date: 5/19/2009



Project Assumptions

Number of Turbines	1
Total Installed Capacity (kW)	1,500
Average Wind Speed (m/s)	6.7
Wind Speed mph	15.1
Annual Energy Output (kWh)	4,023,750.0
Capacity Factor	31%
Maintenance ($/kWh)	$ 0.012
Annual Maintenance Cost	$ 48,285
Escalation Rate	3.0%
Annual Maintenance Reserve	$ 25,000
Annual Insurance Cost	$ 15,000
Escalation Rate	3.0%
Power Purchase Price ($/kWh)	$ 0.094
Annual Energy Value	$ 377,441
Power Purchase Escalator	(enter below)
REC (Green Tag) Value	(enter below)

Cost Summary

Turbine Cost (per turbine)	$ 2,600,000
Tower Cost (per turbine)	$ -
Installation Cost (incl 100K transaction cost	$ 1,718,673
Development Costs	$ 232,705
Subtotal	$ 4,551,378
Earmark	$ (1,400,000)
Earmark (%)	31%
Net Installed Cost	$ 3,151,378
Cost/kW	$ 2,101

Cash In Summary

Cash In Summary	0%
Amount to be Financed	
Cash In Total	$ -
Term of Cash Repayment (years)	
Cash Interest Rate (annual)	
Annual Cash Payback	
Monthly Cash Payback	$ -

Equity Summary

Percentage Equity	
Amount of Debt	$ 3,151,378
Amount Equity	$ -
Equity Term (years)	
Equity Interest Rate (annual)	
Annual Equity Payment	#DIV/0!
Monthly Equity Payment	#DIV/0!

Debt Summary

Percentage Debt	100%
Remaining Amount	$ -
Amount of Debt	$ 3,151,378
Debt Term (years)	15
Debt Interest Rate (annual)	1.0%
Annual Debt Payment	$ 227,289
Monthly Debt Payment	$ 18,941

Tax & Financial Assumptions

Discount Rate (for NPV)	5.5%
Customer Tax Rate (State+Fed)	0.0%
Investment Tax Credit (%)	0%
Investment Tax Credit ($)	$ -
PTC ($/kWh)	$ -
PTC Inflation	0.0%
PTC Yrs Qualified	-

Results

Internal Rate of Return	#DIV/0!
Payback (years)	0.00
NPV at 5.5%	$ 3,432,297
Lifetime Net Savings	$ 6,572,769
Lifetime Energy Output (kWh)	80,475,000
Average Lifetime Cost/kWh of Grid Power	$ 0.130
Lifetime Fixed Cost/kWh of Wind Energy	$ 0.048

Detailed Project Economics Estimate for Udel - Lewes - Site 1

	Total	Levelized Cost / kWh	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Costs												
Up-Front Cost/Down Payment	$ -	$0.000	$ -									
Annual Cash Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ (3,409,339)	($0.042)		$ (227,289)	$ (227,289)	$ (227,289)	$ (227,289)	$ (227,289)	$ (227,289)	$ (227,289)	$ (227,289)	$ (227,289)
Maintenance Variable	$ (1,170,566)	($0.015)		$ (20,000)	$ (20,000)	$ (48,285)	$ (49,734)	$ (51,226)	$ (52,762)	$ (54,345)	$ (55,976)	$ (57,655)
Maintenance Reserve	$ (500,000)	($0.006)		$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)
Insurance	$ (403,056)	($0.005)		$ (15,000)	$ (15,450)	$ (15,914)	$ (16,391)	$ (16,883)	$ (17,389)	$ (17,911)	$ (18,448)	$ (19,002)
Total Costs	$ (5,482,961)	($0.068)	$ -	$ (287,289)	$ (287,739)	$ (316,488)	$ (318,414)	$ (320,397)	$ (322,441)	$ (324,545)	$ (326,713)	$ (328,946)
PV of Costs	$ (3,454,068)	($0.043)	$ -	$ (272,312)	$ (258,520)	$ (269,525)	$ (257,029)	$ (245,147)	$ (233,849)	$ (223,104)	$ (212,886)	$ (203,166)
Benefits												
Utility Escalation Rate				3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 10,446,230	$0.130		$ 388,764	$ 400,427	$ 412,440	$ 424,813	$ 437,557	$ 450,684	$ 464,204	$ 478,130	$ 492,474
REC (Green Tag) Value ($/kWh)		$0.000		$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020
REC (Green Tag) Value ($)	$ 1,609,500	$0.020		$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475
Total Income	$ 12,055,730	$0.150		$ 469,239	$ 480,902	$ 492,915	$ 505,288	$ 518,032	$ 531,159	$ 544,679	$ 558,605	$ 572,949
PV of Income	$ 6,886,365	$0.086		$ 444,776	$ 432,067	$ 419,773	$ 407,877	$ 396,364	$ 385,221	$ 374,433	$ 363,987	$ 353,870
Income Tax Impact												
Investment Tax Credit	$ -		$ -									
5-yr MACRS Double Declining Balance Sched.			60.00%	16.00%	9.60%	5.76%	5.76%	2.88%				
Tax Value of MACRS 5-year Depreciation	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 12,055,730	$0.150	$ -	$ 469,239	$ 480,902	$ 492,915	$ 505,288	$ 518,032	$ 531,159	$ 544,679	$ 558,605	$ 572,949
Maintenance + Insurance	$ (1,573,622)	($0.020)		$ (35,000)	$ (35,450)	$ (64,199)	$ (66,124)	$ (68,108)	$ (70,151)	$ (72,256)	$ (74,424)	$ (76,656)
Interest Expense	$ (257,961)	($0.003)		$ (31,514)	$ (29,556)	$ (27,579)	$ (25,582)	$ (23,565)	$ (21,527)	$ (19,470)	$ (17,391)	$ (15,292)
Tax Benefit (Charge) due to Net Change in Income	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$0.127	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$0.000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary												
Cash Flow after Tax			$ -	$ 181,950	$ 193,162	$ 176,427	$ 186,874	$ 197,635	$ 208,718	$ 220,134	$ 231,893	$ 244,004
Accumulated Cash Flow	**$ 6,572,769**	**$0.209**	$ -	$ 181,950	$ 375,112	$ 551,539	$ 738,413	$ 936,047	$ 1,144,766	$ 1,364,900	$ 1,596,792	$ 1,840,796
PV of Cash Flow			$ -	$ 172,464	$ 173,547	$ 150,247	$ 150,848	$ 151,217	$ 151,372	$ 151,328	$ 151,101	$ 150,704
NPV at 5.5%	**$ 3,432,297**											
Payback Yrs	0.00											
IRR	#DIV/0!											

	Year 10	Year 11	Year … 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Costs												
Up-Front Cost/Down Payment												$ -
Annual Cash Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ (227,289)	$ (227,289)	$ (227,289)	$ (227,289)	$ (227,289)	$ (227,289)	$ -	$ -	$ -	$ -	$ -	$ (3,409,339)
Maintenance Variable	$ (59,384)	$ (61,166)	$ (63,001)	$ (64,891)	$ (66,838)	$ (68,843)	$ (70,908)	$ (73,035)	$ (75,226)	$ (77,483)	$ (79,808)	$ (1,170,566)
Maintenance Reserve	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (500,000)
Insurance	$ (19,572)	$ (20,159)	$ (20,764)	$ (21,386)	$ (22,028)	$ (22,689)	$ (23,370)	$ (24,071)	$ (24,793)	$ (25,536)	$ (26,303)	$ (403,056)
Total Costs	$ (331,245)	$ (333,614)	$ (336,054)	$ (338,567)	$ (341,155)	$ (343,821)	$ (119,278)	$ (122,106)	$ (125,019)	$ (128,020)	$ (131,110)	$ (5,482,961)
PV of Costs	$ (193,921)	$ (185,126)	$ (176,758)	$ (168,796)	$ (161,219)	$ (154,009)	$ (50,643)	$ (49,141)	$ (47,691)	$ (46,289)	$ (44,935)	$ (3,454,068)
Benefits												
Utility Escalation Rate	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity rate savings	$ 507,249	$ 522,466	$ 538,140	$ 554,284	$ 570,913	$ 588,040	$ 605,681	$ 623,852	$ 642,567	$ 661,844	$ 681,700	$ 10,446,230
REC (Green Tag) Value ($/kWh)	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0
REC (Green Tag) Value ($)	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 1,609,500
Total Income	$ 587,724	$ 602,941	$ 618,615	$ 634,759	$ 651,388	$ 668,515	$ 686,156	$ 704,327	$ 723,042	$ 742,319	$ 762,175	$ 12,055,730
PV of Income	$ 344,071	$ 334,578	$ 325,380	$ 316,466	$ 307,826	$ 299,450	$ 291,329	$ 283,454	$ 275,816	$ 268,407	$ 261,219	$ 6,886,365
Income Tax Impact												
Investment Tax Credit												$ -
5-yr MACRS Double Declining Balance Sched.												
Tax Value of MACRS 5-year Depreciation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Tax Value of Production Tax Credit	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Income	$ 587,724	$ 602,941	$ 618,615	$ 634,759	$ 651,388	$ 668,515	$ 686,156	$ 704,327	$ 723,042	$ 742,319	$ 762,175	$ 12,055,730
Maintenance + Insurance	$ (78,956)	$ (81,325)	$ (83,764)	$ (86,277)	$ (88,866)	$ (91,532)	$ (94,278)	$ (97,106)	$ (100,019)	$ (103,020)	$ (106,110)	$ (1,573,622)
Interest Expense	$ (13,172)	$ (11,031)	$ (8,869)	$ (6,685)	$ (4,478)	$ (2,250)	$ -	$ -	$ -	$ -	$ -	$ (257,961)
Tax Benefit (Charge) due to Net Change in Income	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Tax Benefit (Charge)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PV of Tax Impact	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Summary												
Cash Flow after Tax	$ 256,478	$ 269,327	$ 282,561	$ 296,193	$ 310,233	$ 324,694	$ 566,879	$ 582,221	$ 598,023	$ 614,300	$ 631,064	$ 6,572,769
Accumulated Cash Flow	$ 2,097,274	$ 2,366,601	$ 2,649,163	$ 2,945,355	$ 3,255,588	$ 3,580,282	$ 4,147,161	$ 4,729,382	$ 5,327,405	$ 5,941,705	$ 6,572,769	$ 6,572,769
PV of Cash Flow	$ 150,150	$ 149,452	$ 148,622	$ 147,670	$ 146,607	$ 145,441	$ 240,686	$ 234,313	$ 228,125	$ 222,118	$ 216,284	$ 3,432,297

Project Economics Flip Ownership Struc

(No USER INPUTS)

Contact: Kevin Schulte 585 265 2384
kevin@sed-net.com

SUSTAINABLE ENERGY DEVELOPMENTS INC.

Prepared for: Udel Lewes Site 1 GE SLE1.5 MW **Location:** Lewes, DE

Date: 5/19/2009

Project Assumptions

Number of Turbines	1
Total Installed Capacity (kW)	1,500
Average Wind Speed (m/s)	6.7
Wind Speed mph	15.1
Annual Energy Output (kWh)	4,023,750.0
Capacity Factor	31%
Maintenance ($/kWh)	$ 0.012
Warranty Period Maintenece Cost	$ 25,000
Annual Maintenance Cost	$ 48,285
Escalation Rate	3.0%
Annual Maintenance Reserve	$ 25,000
Annual Insurance Cost	$ 15,000
Escalation Rate	3.0%
Power Purchase Price ($/kWh)	$ 0.094
Annual Energy Value	$ 377,428
Power Purchase Escalator	(enter below)
REC (Green Tag) Value	(enter below)

Cost Summary

Turbine Cost (per turbine)	$2,600,000
Tower Cost (per turbine)	$ -
Installation Cost	$1,718,653
Development Costs	$ 232,705
Subtotal	$4,554,158
State/Utility/USDA Rebate	#########
State/Utility/USDA Rebate (%)	31%
Net Installed Cost	**$3,151,358**
Cost/kW	$ 2,101

Equity Summary

Percentage Equity	0%
Amount of Debt	$3,151,358
Amount Equity	$ -
Equity Term (years)	7
Equity Interest Rate (annual)	10.0%
Annual Equity Payment	$ -
Monthly Equity Payment	$ -

Tax & Financial Assumptions

Discount Rate (for NPV)	8.0%
	0
Customer Tax Rate (State+Fed)	35.0%
	0
Investment Tax Credit (%)	30%
Investment Tax Credit ($)	$1,365,407
PTC ($/kWh)	$ -
PTC Inflation	0.0%
PTC Yrs Qualified	-

Cash In Summary

Cash In Summary	0%
Amount to be Financed	$3,151,358
Cash In Total	$ -
Term of Cash Repayment (years)	3
Cash Interest Rate (annual)	12.0%
Annual Cash Payback	$ -
Monthly Cash Payback	$ -

Debt Summary

Percentage Debt	0%
Remaining Amount	$3,151,358
Amount of Debt	$ -
Debt Term (years)	10
Debt Interest Rate (annual)	7.0%
Annual Debt Payment	$ -
Monthly Debt Payment	$ -

Results

Internal Rate of Return	60.9%
Payback (years)	1.35
NPV at 8%	$ -
Lifetime Net Savings	$3,586,405
Lifetime Energy Output (kWh)	80,475,000
Average Lifetime Cost/kWh of Grid Power	$ 0.057
Lifetime Fixed Cost/kWh of Wind Energy	#REF!

Ownership Flip Structure

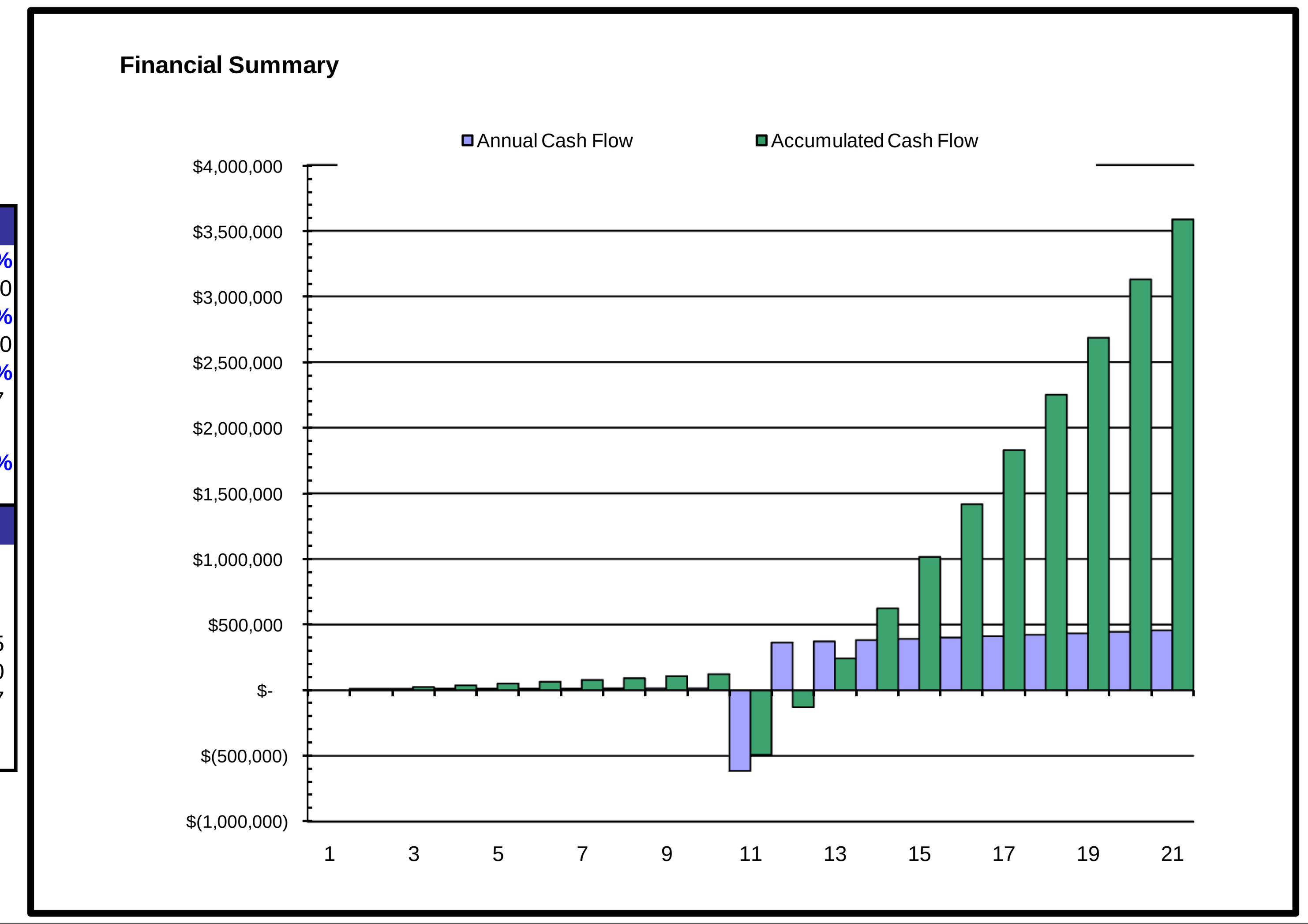
Flip Year	10
Percentage of Original Installed Cost	20.0%
Total Flip Payment	$ 630,272

PILOT Payment Summary

PILOT Payment ($/MW)	$ -
Total Payment ($)	$ -
PILOT Escalation Rate (%)	0.0%

Land Payment Summary

Land Payment (%)	0.2%
Total Payment ($)	$ 783



Detailed Project Economics Estimate for Udel Lewes Site 1

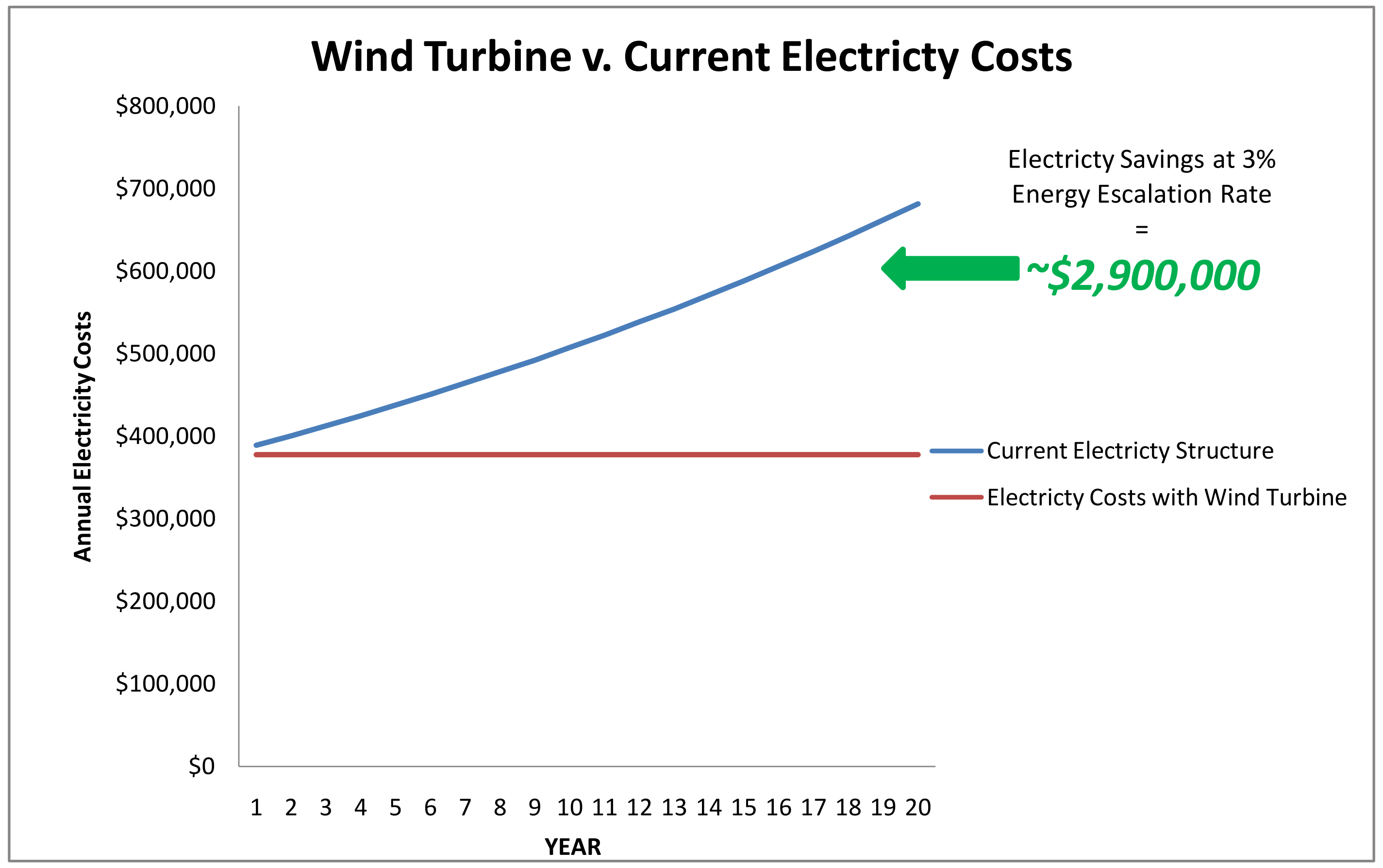
	Total	Levelized Cost / kWh	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Costs													
Up-Front Cost/Down Payment	$ -	$0.000	$ -										
Annual Cash Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (701,200)	($0.009)		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Reserve	$ (250,000)	($0.003)		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Insurance	$ (231,097)	($0.003)		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Flip Payment	$ (630,272)	($0.008)		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (630,272)
Total Costs	$ (1,812,569)	($0.015)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (630,272)
PV of Costs	$ (654,046)	($0.008)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (291,938)
Benefits													
Utility Escalation Rate				3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity Sale/Savings Value	$ 4,586,393	$0.057		$ 11,323	$ 11,663	$ 12,012	$ 12,373	$ 12,744	$ 13,126	$ 13,520	$ 13,926	$ 14,343	$ 14,774
REC (Green Tag) Value ($/kWh)		$0.000											
REC (Green Tag) Value ($)	$ 804,750	$0.010		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PILOT Payment	$ -	$0.000		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Land Payment	$ 7,830	$0.000		$ 783	$ 783	$ 783	$ 783	$ 783	$ 783	$ 783	$ 783	$ 783	$ 783
Total Income	$ 5,398,973	$0.067		$ 12,106	$ 12,446	$ 12,795	$ 13,156	$ 13,527	$ 13,909	$ 14,303	$ 14,709	$ 15,126	$ 15,557
PV of Income	$ 1,700,393	$0.021		$ 11,209	$ 10,670	$ 10,157	$ 9,670	$ 9,206	$ 8,765	$ 8,346	$ 7,947	$ 7,567	$ 7,206
Summary													
Annual Cash Flow			$ -	$ 12,106	$ 12,446	$ 12,795	$ 13,156	$ 13,527	$ 13,909	$ 14,303	$ 14,709	$ 15,126	$ (614,715)
Accumulated Cash Flow	**$ 3,586,405**	**$0.052**	$ -	$ 12,106	$ 24,551	$ 37,347	$ 50,503	$ 64,030	$ 77,939	$ 92,242	$ 106,951	$ 122,077	$ (492,638)
PV of Cash Flow			$ -	$ 11,209	$ 10,670	$ 10,157	$ 9,670	$ 9,206	$ 8,765	$ 8,346	$ 7,947	$ 7,567	$ (284,732)
NPV at 8%	$ -												
Payback Yrs (After Ownership Flip)	1.35												
IRR	60.94%												

	Year 11	Year ... 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Costs											
Up-Front Cost/Down Payment											$ -
Annual Cash Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Equity Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Debt Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Maintenance Variable	$ (61,166)	$ (63,001)	$ (64,891)	$ (66,838)	$ (68,843)	$ (70,908)	$ (73,035)	$ (75,226)	$ (77,483)	$ (79,808)	$ (701,200)
Maintenance Reserve	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (250,000)
Insurance	$ (20,159)	$ (20,764)	$ (21,386)	$ (22,028)	$ (22,689)	$ (23,370)	$ (24,071)	$ (24,793)	$ (25,536)	$ (26,303)	$ (231,097)
Flip Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (630,272)
Total Costs	$ (106,325)	$ (108,764)	$ (111,277)	$ (113,866)	$ (116,532)	$ (119,278)	$ (122,106)	$ (125,019)	$ (128,020)	$ (131,110)	$ (1,812,569)
PV of Costs	$ (45,601)	$ (43,192)	$ (40,916)	$ (38,767)	$ (36,736)	$ (34,816)	$ (33,001)	$ (31,286)	$ (29,664)	$ (28,129)	$ (654,046)
Benefits											
Utility Escalation Rate	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Electricity Sale/Savings Value	$ 388,751	$ 400,413	$ 412,425	$ 424,798	$ 437,542	$ 450,668	$ 464,189	$ 478,114	$ 492,458	$ 507,231	$ 4,586,393
REC (Green Tag) Value ($/kWh)	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0.020	$ 0
REC (Green Tag) Value ($)	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 80,475	$ 804,750
PILOT Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Land Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,830
Total Income	$ 469,226	$ 480,888	$ 492,900	$ 505,273	$ 518,017	$ 531,143	$ 544,664	$ 558,589	$ 572,933	$ 587,706	$ 5,398,973
PV of Income	$ 201,243	$ 190,967	$ 181,238	$ 172,026	$ 163,301	$ 155,036	$ 147,206	$ 139,786	$ 132,755	$ 126,091	$ 1,700,393
Summary											
Annual Cash Flow	$ 362,901	$ 372,124	$ 381,623	$ 391,408	$ 401,485	$ 411,866	$ 422,558	$ 433,570	$ 444,913	$ 456,596	$ 3,586,405
Accumulated Cash Flow	$ (129,737)	$ 242,387	$ 624,010	$ 1,015,417	$ 1,416,903	$ 1,828,768	$ 2,251,326	$ 2,684,896	$ 3,129,809	$ 3,586,405	$ 3,586,405
PV of Cash Flow	$ 155,642	$ 147,775	$ 140,322	$ 133,259	$ 126,565	$ 120,220	$ 114,204	$ 108,500	$ 103,092	$ 97,962	$ 1,046,347
NPV at 8%											

Project Economics - Third Party, Unleverage

	Total	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Current Electricty Structure	$ 10,445,874		$388,751	$400,413	$412,425	$424,798	$437,542	$450,668	$464,189	$478,114	$492,458
PPA Price	$ 8,861,207		$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428
Electricty Costs with Wind Turbine	$ 8,861,207		$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428
Benefit To Udel	$ 2,897,319		$11,323	$22,985	$34,998	$47,371	$60,114	$73,241	$86,761	$100,686	$115,030

	Year 10	Year 11	Year … 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Total
Current Electricty Structure	$507,231	$522,448	$538,122	$554,265	$570,893	$588,020	$605,661	$623,831	$642,545	$661,822	$681,676	$10,445,874
PPA Price	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$7,548,555
Electricty Costs with Wind Turbine	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$377,428	$7,548,555
Benefit To Udel	$129,804	$145,021	$160,694	$176,838	$193,466	$210,592	$228,233	$246,403	$265,118	$284,394	$304,249	$2,897,319



APPENDIX F

Geotechnical Review

DUFFIELD ASSOCIATES
Consultants in the Geosciences

Duffield Associates, Inc.
5400 Limestone Road
Wilmington, DE 19808-1232
Phone: 302.239.6634
Fax: 302.239.8485
duffnet.com

April 29, 2009

Mr. John Trout
Sustainable Energy Development, Inc.
317 Route 104
Ontario, NY 14519-8958

RE: Project No. 7997.GA
Preliminary Desktop Geotechnical Review
Proposed Lewes Wind Turbine
Lewes, Delaware

Dear Mr. Trout:

Duffield Associates, Inc. (Duffield Associates) has prepared this report to summarize our preliminary desktop geotechnical review for a proposed wind turbine to be constructed in Lewes, Delaware. The purpose of this study was to review the general subsurface conditions in the area of the proposed wind turbine and to provide Sustainable Energy Development, Inc. (SED) with general comments concerning foundation types for a proposed 80 meter (approximately 262 feet) high wind turbine. These services were performed in general accordance with our agreement dated April 13, 2009.

Background

To assist with this review, SED provided us with the following documents via electronic mail on April 9 and 15, 2009:

- A document titled "GE Wind Energy – WTGS Foundations – Design Requirements – Gravity Spread (Raft) Type & Pole Type Foundations," developed by GE Wind Energy, dated November 2, 2004;

- A document titled " Foundation Data for Wind Turbine Generator Systems," developed by GE Energy and copyrighted 2007; and

- An aerial photograph indicating five (5) potential sites for the wind turbine.

Based on our discussions, we understand that it is proposed to construct an approximately 1.5 MW, 80 meter high wind turbine at one of five proposed locations in Lewes, Delaware. The sites are located off of Pilottown Road in the general vicinity of the University of Delaware's Virden Center. A site location sketch ("Surficial Geologic Map") is attached to this report and indicates the proposed turbine locations in relation to near surface soil deposits as mapped by the Delaware Geologic Survey (DGS).

The information developed by GE generally indicates the following approximate maximum loads (inclusive of GE safety factors) for 80 meter high turbines operating at 60Hz:

- Maximum resultant moment = 47,125 kN-m (417,000 kip-ft);

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- Maximum resultant shear force = 706.5 kN (159 kips); and
- Maximum axial compressive load = 2,640 kN (593.5 kips).

Significant cyclical, dynamic loads are also imposed as a result of the turbine's operation.

Generalized Subsurface Stratigraphy

The general project site is located within the Atlantic Coastal Plain Physiographic Province. Regional mapping performed by DGS indicates that the near surface site soils in the vicinity of the five proposed turbine locations consist of either marsh deposits, "upland formations" (indicated as "Scotts Corners Formation" on the attached sketch) or "fill." Marsh deposits are indicated to consist of shaded gray clay loam soils with plant remains. The thickness of these marsh deposits vary with thicker deposits (on the order of 10 feet) nearest to Canary Creek and becoming thinner further away from the creek. The "upland formations" are primarily unconsolidated sands and extend to approximately 15 feet below the existing ground surface. The "fill" soils are indicated to be the result of dredging activities in the nearby Roosevelt Inlet, Lewes-Rehoboth Canal, and the University of Delaware's dock area. Previous sampling by Duffield Associates within the inlet, canal, and dock areas suggests that the "fill" consists of fine-grained silts and clays with varying amount of organics. The depth of these deposits varies significantly depending on the specific location; however, depths on the order of several feet to 20 feet are anticipated.

Below these near surface deposits, soils generally consist of unconsolidated sands deposited in marine environments. However, unconsolidated silt and clay veins are also mapped within the sand deposits as a result of varying geologic conditions (e.g., lagoonal deposits, etc.) which have occurred throughout geologic time. These veins can be on the order of inches to several feet thick. In general, this stratigraphy extends on the order of 100 feet or more below the existing ground surface. Review of the referenced mapping also indicates that the depth to bedrock is greater than 4,000 feet.

A description of each site location (see attached sketch) is as follows:

- "Location 1" – This proposed location is indicated to be in an "upland area" (i.e., not marsh or "fill" site). Subsurface soils are anticipated to consist of a surficial layer of topsoil (on the order of a couple feet thick) underlain by upland deposits (primarily sand deposits with possible silt or clay veins). Current site conditions in this area appear to be slightly within or on the boundary of a wooded area;

- "Location 2" – This proposed location is indicated to be in a "fill" area. This site area appears to be within a wooded area. Therefore, topsoil is anticipated at the ground surface underlain by several feet of "fill" subsequently underlain by soils similar to "Location 1;"

- "Location 3" – This proposed location is also indicated to be in a "fill" area. This site area appears to be within a "wetlands-like" area consisting of tall grass and small brush and heavily influenced by tidal water levels. Subsurface soils (beneath the "fill") are anticipated to be similar to "Location 2;"

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- "Location 4" – This proposed location is indicated to be in a "marsh" area. Due to the relative distance from Canary Creek, the marsh deposits are anticipated to be on the order of a few feet deep (as opposed to tens of feet deep). Subsurface soils below the marsh deposits are anticipated to be similar to the other locations; and

- "Location 5" – This proposed location is indicated to be in a "fill" area and is anticipated to be similar to "Location 2."

Due to the site's proximity to the Delaware Bay, groundwater levels will be tidally influenced. Based on Duffield Associates previous test borings in this general area, groundwater has been encountered at depths ranging from approximately 6 to 9 feet below the existing ground surface in the upland areas (elevations ranging from approximately 0 to -3 feet, NAVD88 datum). Groundwater levels in the marsh area are essentially at the ground surface.

Discussion

The design information provided by GE indicates that foundations for wind turbine generating systems (WTGS) typically consist of structural mat (raft) foundations or a deep foundation system (e.g., drilled shafts, driven piles, etc.).

The near surface soils consisting of loose density/soft consistency sands and clays containing organics are not considered suitable for support of a shallow foundation system. Shallow foundations, such as structural mats, bearing on the unconsolidated marine deposits described above and previously encountered by Duffield Associates in this general area, are typically designed with maximum allowable bearing pressures on the order of 1,500 pounds per square feet and are susceptible to settlement on the order of several inches or more (based on the soil consistency, specific loading conditions and size of foundation). While mat foundations can be utilized to control differential settlement and are applicable in areas of weaker soils, the proposed loading conditions (e.g., cyclic, high overturning moments, etc.) may result in an impractically sized foundation for the proposed WTGS. Therefore, Duffield Associates has considered two types of deep foundation systems: drilled shafts and driven piles for support of the proposed WTGS. As massive rock conditions are not anticipated within a practical foundation depth, the deep foundation support system will derive its capacity primarily through skin friction.

- Drilled Shaft Foundations. Drilled shaft foundations can be constructed at various depths and diameters to meet the foundation design criteria. This type of foundation system can also be designed to provide the rigidity requirements necessary for WTGS foundation systems. Drilled shafts are typically constructed utilizing drilling augers mounted to a crane or attached to a truck. Shaft diameters ranging from 2 feet to in excess of 10 feet can be constructed. The volume of soil cuttings generated from the shaft construction can become significant depending on the shaft depth and diameter. Due to this, drilled shafts become less desirable where it is necessary to reduce the amount of soil generated by foundation installation.

  Based on the loading conditions provided by GE and the anticipated subsurface stratigraphy, we anticipate that a drilled shaft foundation system would consist of a single, "large diameter" shaft (e.g., on the order of 5 feet or greater) or several smaller diameter shafts embedded on the order of

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75 to 100 feet. Due to the relatively high groundwater table in this area, it is anticipated that casing would be required in order to advance the shaft to the specified depth. Overturning resistance and lateral capacity of the shaft(s) will be dependent on the specific subsurface stratigraphy and are beyond the scope of this preliminary assessment.

- Driven Pile Foundations. Driven pile foundations are also versatile in depth and diameter. Typical pile types for this application could consist of precast concrete, steel H-piles, or steel pipe piles. Multiple piles can be driven to provide the required stiffness, as well as redundancy. Driven pile foundations also typically result in less spoils being generated (as compared to drilled shafts). Piles are typically driven utilizing a crane mounted pile hammer.

  Duffield Associates estimates that piles driven to depths on the order of 75 to 100 feet below the existing ground surface will be required to develop the specified foundation capacities.

Conclusions

Based on the information provided, as well as our previous experience in the general site area, Duffield Associates offers the following conclusions.

1. Subsurface Stratigraphy. Duffield Associates understands that five sites are currently being considered for the WTGS, three of which appear to be within "fill" areas ("Location 2," "Location 3," and "Location 5"), one in an upland area ("Location 1"), and one in a marsh area ("Location 4"). Based on mapping by DGS, as well as our recent experience in the general area of the site, it appears that, below a surficial layer of "fill" or marsh deposits, the subsurface soils at all five proposed sites are anticipated to consist of unconsolidated marine deposits comprised primarily of loose to medium density sands with occasional silt or clay veins. Massive rock is not anticipated within a practical foundation depth. While near surface (i.e., upper 10 to 20 feet) and ground surface conditions may vary between the five sites, the underlying geology does not appear to differ substantially from a geotechnical perspective.

2. Foundation Alternatives. As indicated in the GE WTGS design information provided, Duffield Associates has considered foundation types consisting of shallow structural mat (raft foundation) and deep foundations. Due to the relative soft consistency/loose density of the subsurface soils, a structural mat foundation may be impractical to construct given the required criteria (e.g., high overturning moment, cyclical nature of loads, etc.). Therefore, Duffield Associates has considered two types of deep foundation systems: drilled shafts and driven piles. Both systems are anticipated to derive their capacity primarily from skin friction (as opposed to end bearing) and can be constructed at various geometries (diameter, depth, spacing, number of shafts/piles, etc.) in order to meet the foundation design criteria. The choice of a specific foundation type will be dependent on the available site footprint, as well as the relative stiffness of the foundation systems, and the relative cost.

3. Geotechnical Evaluation Recommendations. We understand that SED is currently reviewing the five potential sites and desires to choose a single site prior to moving forward with design. Following choosing a site, Duffield Associates recommends that at least one boring (Standard Penetration Test and/or Cone Penetration Test) be performed to a depth of at least 100 feet below

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the existing ground surface. In addition, due to the cyclical nature of the loads, we also recommend that in-situ dynamic testing be performed in order to develop the necessary foundation design parameters. This type of testing can be performed as part of Cone Penetration testing or independently. We recommend that SED and the design team meet in advance of the proposal to mutually develop a scope of services.

Duffield Associates, Inc.'s comments and recommendations are based on the information provided by SED, as well as mapping by the DGS and previously performed test borings in the general area of this site. These recommendations have been prepared according to generally accepted soil and foundation engineering standards.

We appreciate the opportunity to be of service to you and we would enjoy the opportunity to discuss our findings with you in more detail. If you have any questions concerning this report or require further information, please do not hesitate to contact us.

Very truly yours,

DUFFIELD ASSOCIATES, INC.

Theodore A. Thomson, Jr., Ph.D., P.E.
Project Manager

James F. Cloonan, P.E.
Senior Consultant

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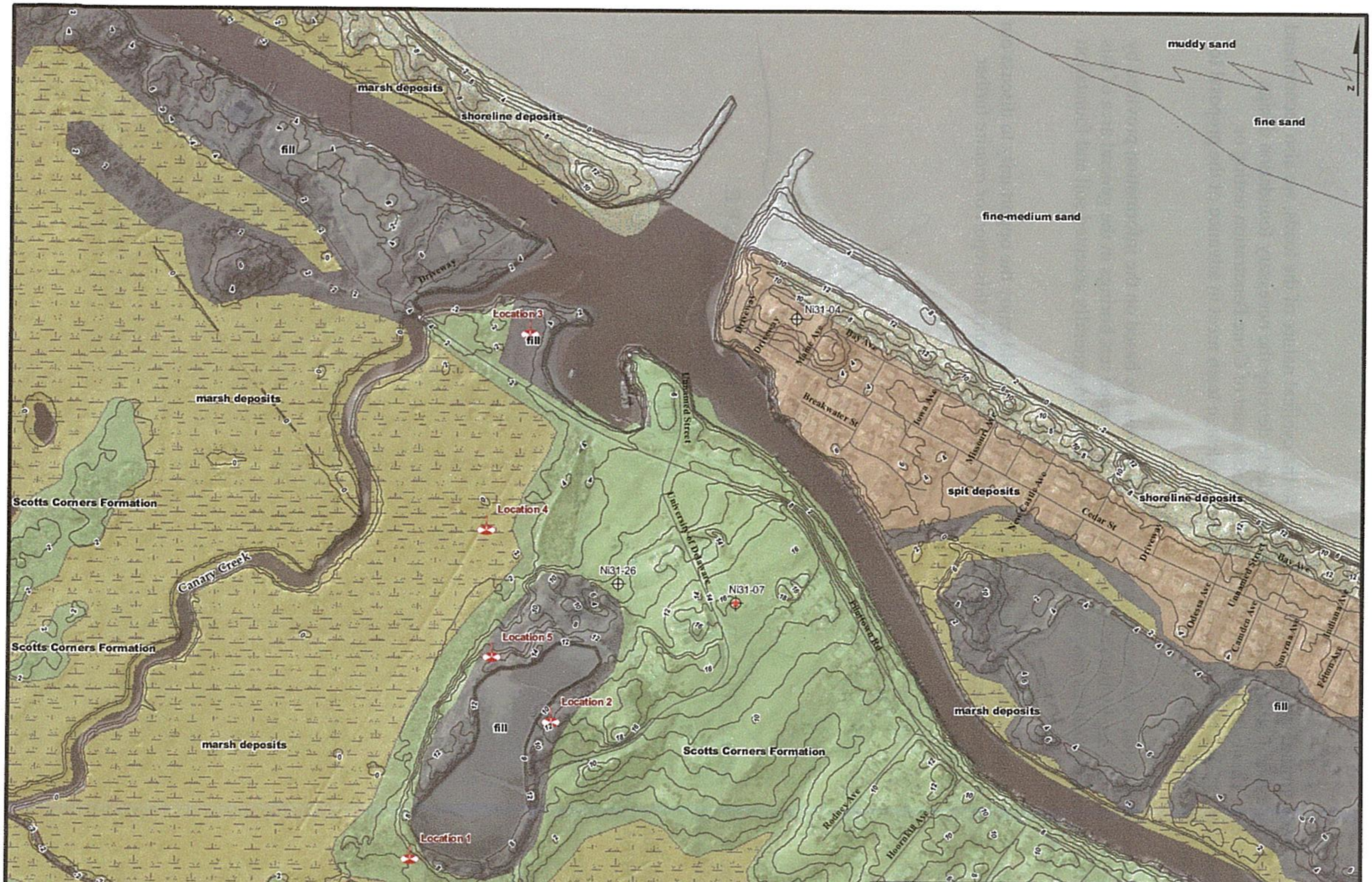
WORD\7997GA.0409-LEWES WIND TURBINE.RPT

Enclosure: "Proposed Lewes, Delaware Wind Turbine" Sketch



NOTES:

1. ELEVATION CONTOURS AVAILABLE FROM THE DELAWARE DATAMIL INTERNET MAPPING SERVICE AND BASED ON A 2002-2005 LIDAR SURVEY (VERTICAL DATUM OF REFERENCE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)).
2. GEOLOGIC MAP AND BORING/WELL DATA COURTESY OF THE DELAWARE GEOLOGICAL SURVEY (DGS).
3. THIS MAP IS PART OF A REPORT TITLED "PRELIMINARY DESKTOP GEOTECHNICAL REVIEW, PROPOSED LEWES, DELAWARE WIND TURBINE," AND AS SUCH SHOULD ONLY BE VIEWED IN THE CONTEXT OF THAT REPORT.
4. PROPOSED TURBINE LOCATIONS AS PROVIDED TO DUFFIELD ASSOCIATES BY SUSTAINABLE ENERGY DEVELOPMENT, INC. VIA ELECTRONIC MAIL ON APRIL 15, 2009.

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Legend

- Proposed Turbine Locations
- DGS Well/Boring Location
- DGS Geophysical Log
- Elevation (2' c.i.)

DGS Geologic Map No. 12

- fill
- fine sand
- fine-medium sand
- muddy sand
- marsh deposits
- shoreline deposits
- spit deposits
- Scotts Corners Formation

BASEMAP: 2007 Aerial Photography

DRAWN BY: ADK

CHECKED BY: TAT

FILE: 7997GA_BASEMAP.mxd

SURFICIAL GEOLOGIC MAP
(SHOWING EXISTING BOREHOLE LOCATIONS)

PROPOSED LEWES, DELAWARE WIND TURBINE

PRELIMINARY DESKTOP GEOTECHNICAL REVIEW

LEWES-SUSSEX COUNTY-DELAWARE

DATE: APRIL 29, 2009

SCALE: AS SHOWN

PROJECT NO. 7997.GA

SHEET: 1 OF 1