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Dear Ms. Rivera,

On the following pages you will the Final Report for the Wind Powering America State Outreach grant.
Regards,

Krishan Kumar Bhatia

Wind Power America State Outreach Grant

Final Progress Report to the NJBPU Office of Clean Energy

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Introduction

This technical report outlines the activities carried out by Rowan University, on behalf of the New Jersey Board of Public Utilities Office of Clean Energy, under the Department of Energy's Wind Powering America - New Jersey State Outreach grant. The activities described occurred during the grant period from September 2007 through September 2008. The project had three main focus areas: Supporting the New Jersey Anemometer Loan Program, Supporting Small and Community Scale Wind Outreach, and Analysis of Current New Jersey Small Wind Model Ordinance.

Supporting the New Jersey Anemometer Loan Program

Under the first provision of the grant, the Office of Clean Energy provided financial support to Rowan University to service, maintain and analyze data on existing anemometers. Costs included erecting, servicing, removing anemometers from their location and analyzing data to determine the wind resource. Funds were used to service and maintain three anemometer sites, namely, LeBak farms in Burlington County, Salem County Utility Authorities in Salem County, and Ocean Gate Township in Ocean County. Anemometers at all three sites have recently completed their data collection for the entire year and all three towers have been removed. A summary of the data for each site is outlined below. Please note that the entire data set for each site consisted of 10 minute averages of the wind speed and direction for an entire year. However, inclusion of the data set in this report, even as an appendix, would be extremely protracted. Please contact Rowan University if more detailed information on the data set is needed.

Site 1: LeBak Farms

Town: Chester field
County: Burlington
GPS: 40 °05.228N 074°38.554W
Height of Mast: 30m

The wind speed distribution for LeBak Farms at 30 meters is shown in Figure 1 and Table 1, the wind speed distribution at 50 meters in Figure 2 and Table 2, and an image of the installation in Figure 3. As shown, the average wind speed for the year was 3.8 meters per second at 30 meters and 4.1 meters per second at 50 meters.

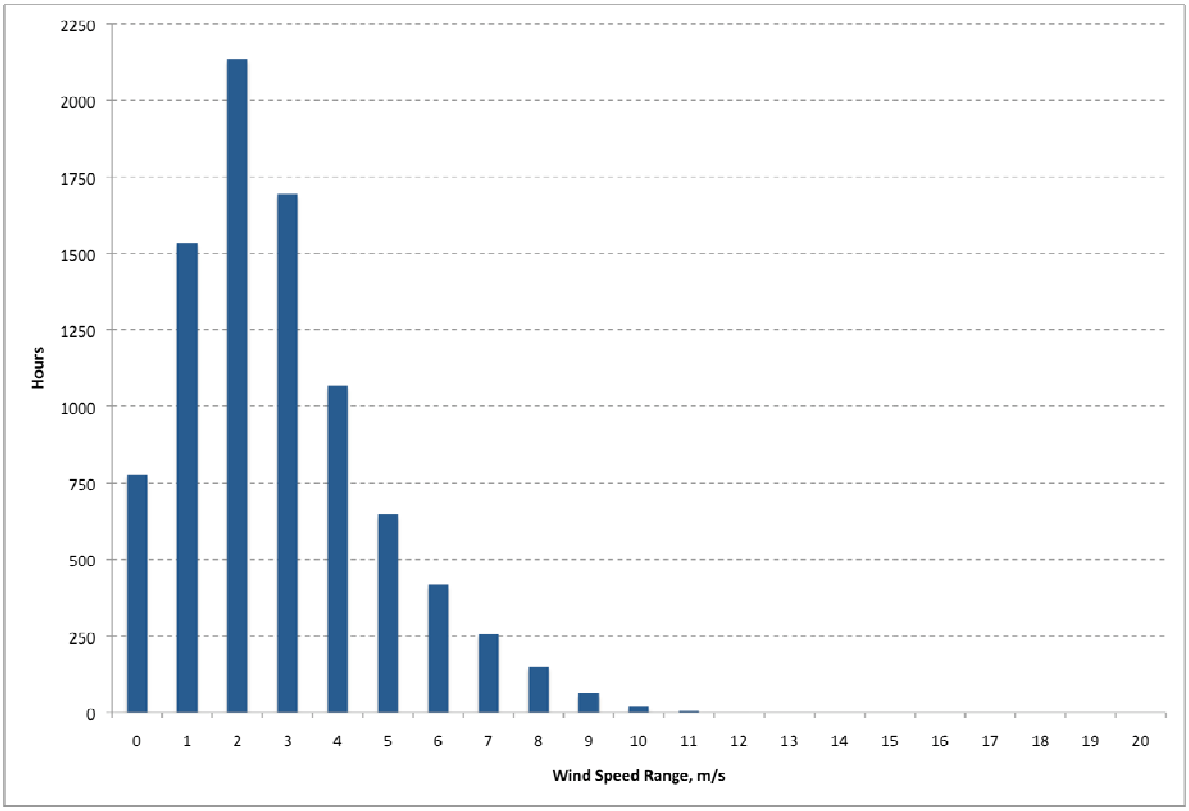

Figure 1: Wind Speed Distribution at LeBak Farms at 30 meters

Table 1: Wind Speed Data at LeBak Farms at 30 meters

Speed Range, m/s	Hours
<1	776.0
1-2	1532.7
2-3	2134.5
3-4	1693.3
4-5	1066.3
5-6	646.5
6-7	418.5
7-8	255.7
8-9	149.3
9-10	62.2
10-11	19.3
11-12	5.2
12-13	0.3
13-14	0.0
14-15	0.0
15-16	0.0
16-17	0.0
17-18	0.0
18-19	0.0
19-20	0.0
>20	0.0
Average Speed, m/s	**3.8**

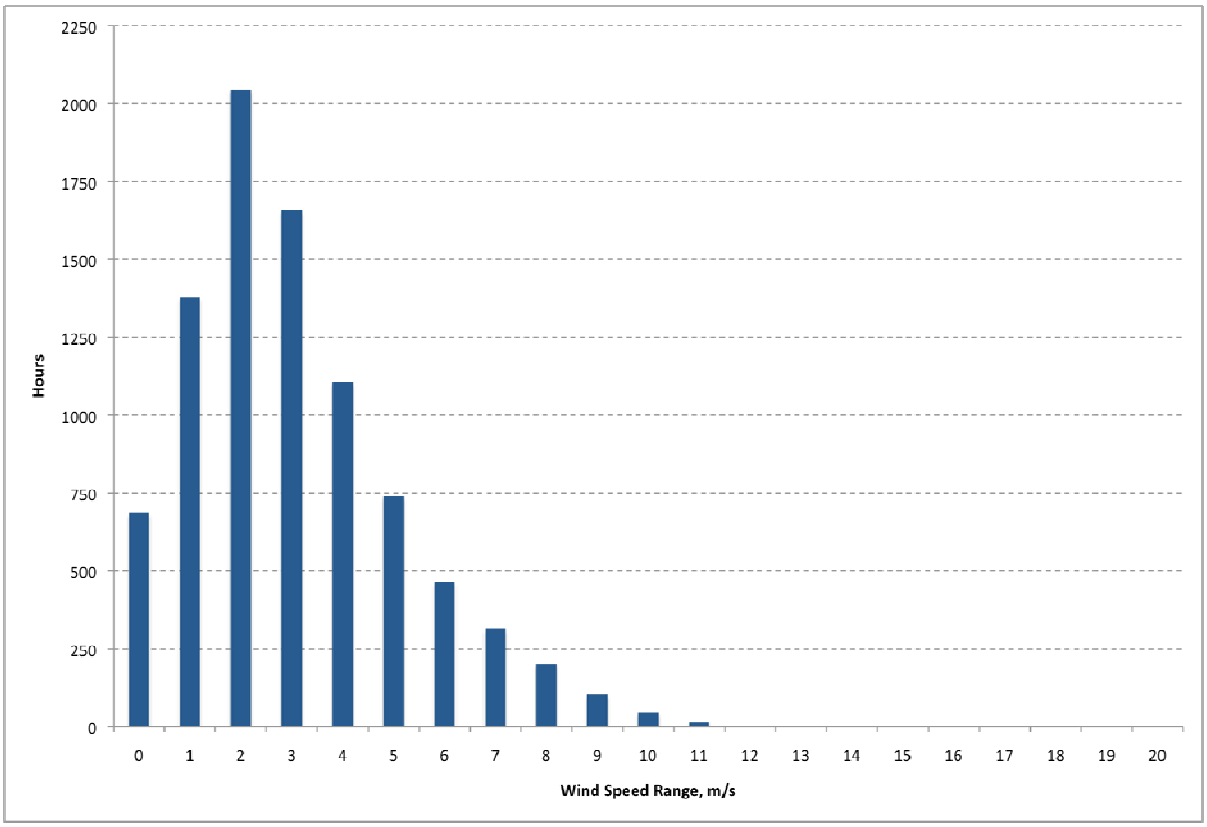

Figure 2: Wind Speed Distribution at LeBak Farms at 50 meters

Table 2: Wind Speed Data at LeBak Farms at 50 meters

Speed Range, m/s	Hours
<1	686.0
1-2	1379.2
2-3	2044.8
3-4	1657.7
4-5	1105.5
5-6	739.8
6-7	465.8
7-8	314.3
8-9	200.5
9-10	101.8
10-11	46.3
11-12	14.3
12-13	3.3
13-14	0.3
14-15	0.0
15-16	0.0
16-17	0.0
17-18	0.0
18-19	0.0
19-20	0.0
>20	0.0
Average Speed, m/s	**4.1**

Figure 3: Tower Installation at LeBak Farms

Site2: Salem County Utility Authorities (SCUA)
Town: Alloway
County: Salem
GPS: 39°35.249N 075°22.245W
Height of Mast: 20m

The wind speed distribution for the landfill at Salem County Utility Authority at 20 meters is shown in Figure 4 and Table 3, the wind speed distribution at 50 meters in Figure 5 and Table 4, and an image of the installation in Figure 6. As shown, the average wind speed for the year was 5.0 meters per second at 20 meters and 5.4 meters per second at 50 meters.

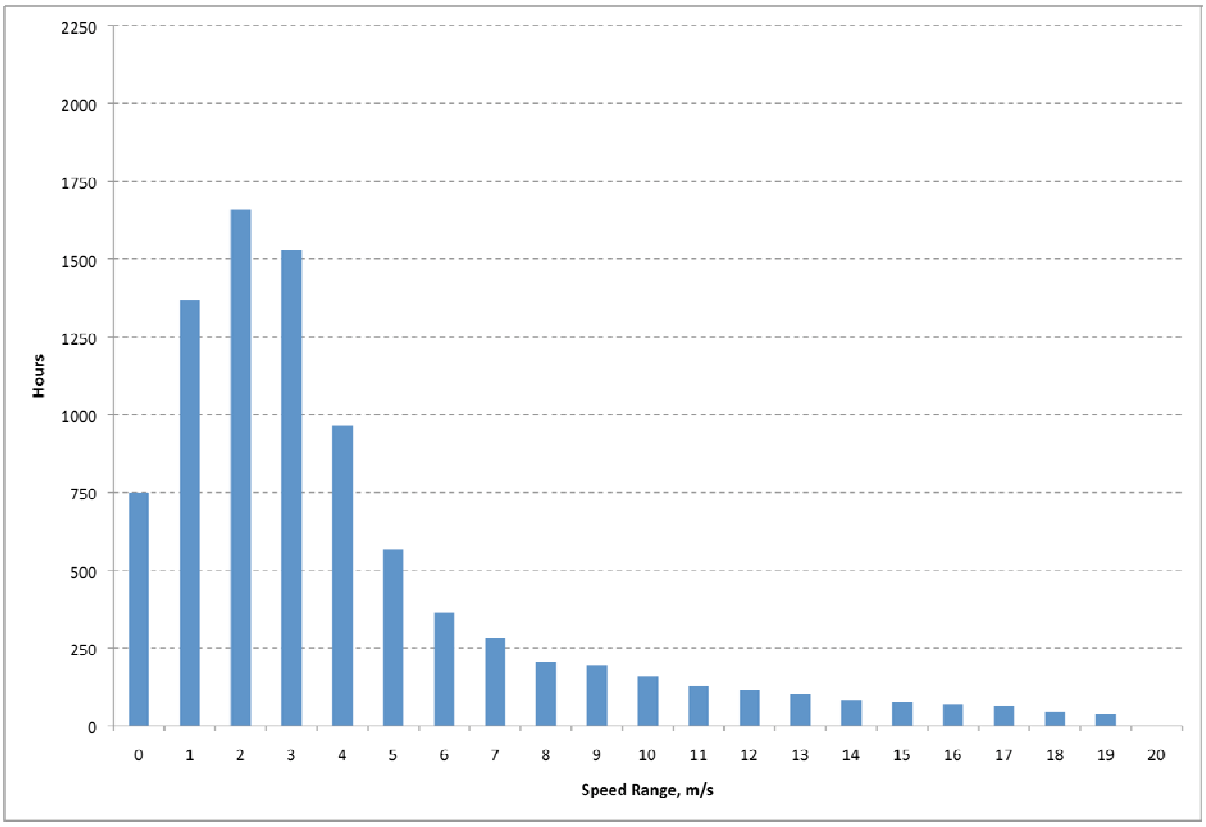

Figure 4: Wind Speed Distribution at SCUA at 20 meters

Table 3: Wind Speed Data at SCUA at 20 meters

Speed Range, m/s	Hours
<1	749.2
1-2	1367.7
2-3	1659.5
3-4	1526.9
4-5	966.5
5-6	567.0
6-7	363.8
7-8	281.7
8-9	205.1
9-10	194.6
10-11	159.1
11-12	129.9
12-13	113.6
13-14	102.4
14-15	82.6
15-16	75.4
16-17	68.6
17-18	64.2
18-19	45.3
19-20	37.0
>20	0.0
Average Speed, m/s	**5.0**

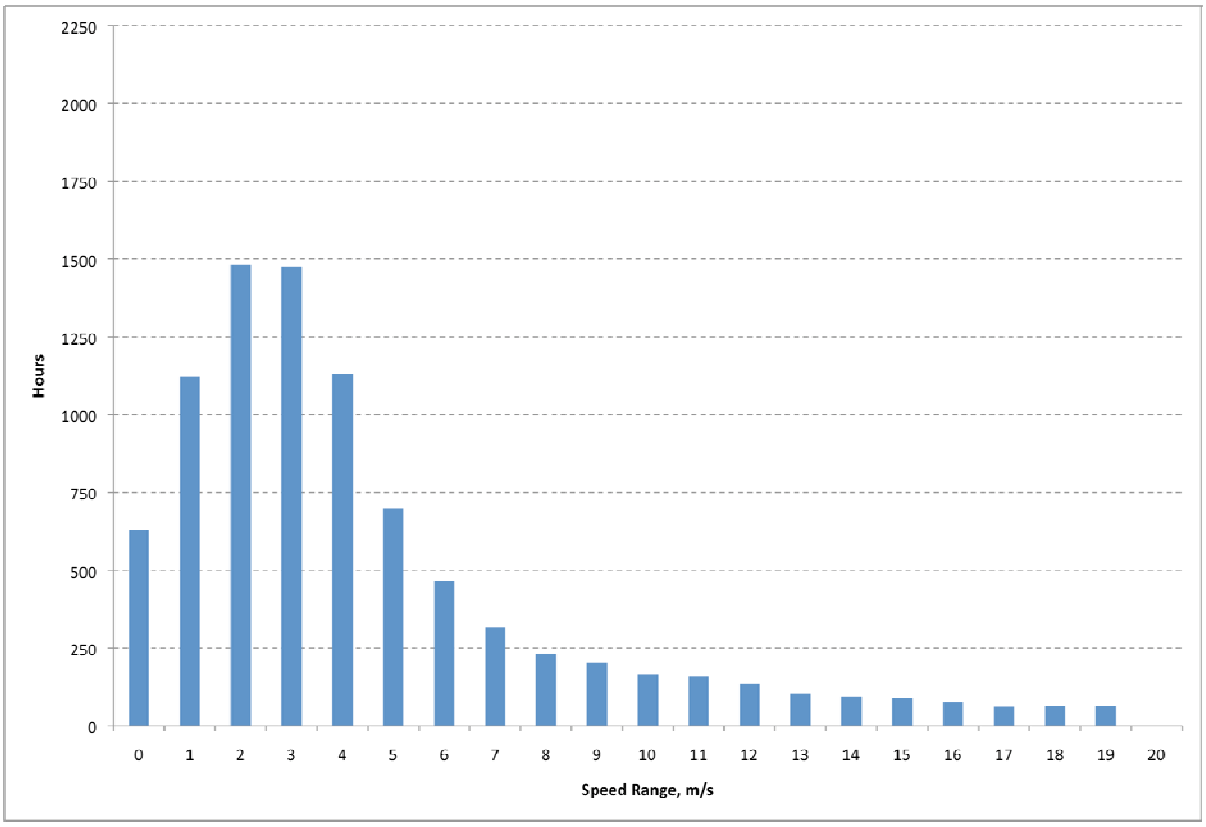

Figure 5: Wind Speed Distribution at SCUA at 50 meters

Table 4: Wind Speed Data at SCUA at 50 meters

Speed Range, m/s	Hours
<1	629.9
1-2	1122.4
2-3	1480.8
3-4	1475.3
4-5	1129.6
5-6	698.3
6-7	466.7
7-8	315.2
8-9	231.2
9-10	201.9
10-11	164.3
11-12	159.1
12-13	135.8
13-14	103.5
14-15	94.8
15-16	90.5
16-17	74.9
17-18	60.1
18-19	62.8
19-20	62.8
>20	0.0
Average Speed, m/s	**5.4**

Figure 6: Tower Installation at SCUA

Site 3: Ocean Gate
Town: Ocean Gate
County: Ocean County
GPS: 39°55.458N 074°08.097W
Height of Mast: 30m

The wind speed distribution for the site located on municipal land in Ocean Gate, NJ at 30 meters is shown in Figure 7 and Table 5, the wind speed distribution at 50 meters in Figure 8 and Table 6, and an image of the installation in Figure 9. As shown, the average wind speed for the year was 4.3 meters per second at 30 meters and 4.6 meters per second at 50 meters.

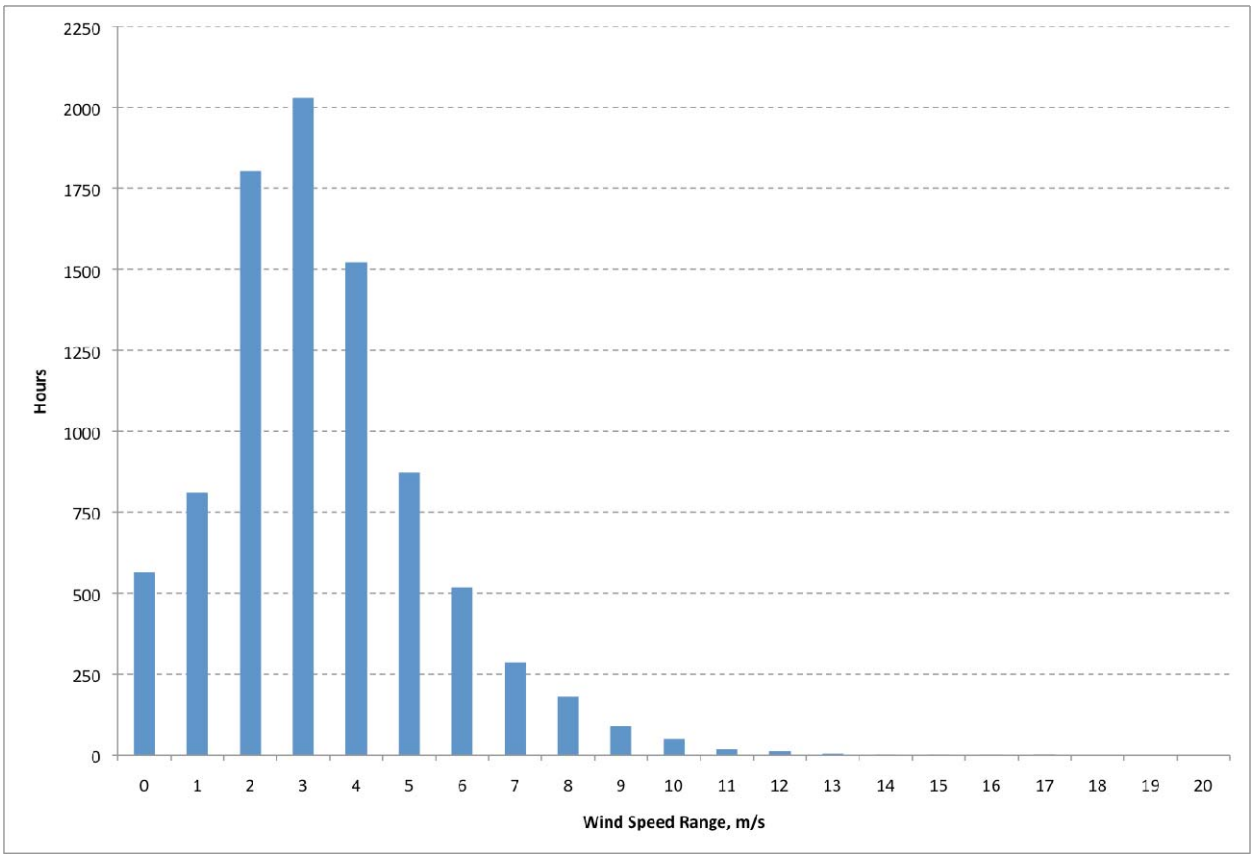

Figure 7: Wind Speed Distribution at Ocean Gate at 30 meters

Table 5: Wind Speed Data at Ocean Gate at 30 meters

Speed Range, m/s	Hours
<1	564.2
1-2	809.9
2-3	1801.2
3-4	2025.8
4-5	1519.7
5-6	872.7
6-7	518.4
7-8	285.8
8-9	180.5
9-10	89.5
10-11	49.2
11-12	19.6
12-13	11.8
13-14	4.7
14-15	1.5
15-16	1.3
16-17	1.3
17-18	1.8
18-19	0.8
19-20	0.0
>20	0.0
Average Speed, m/s	**4.3**

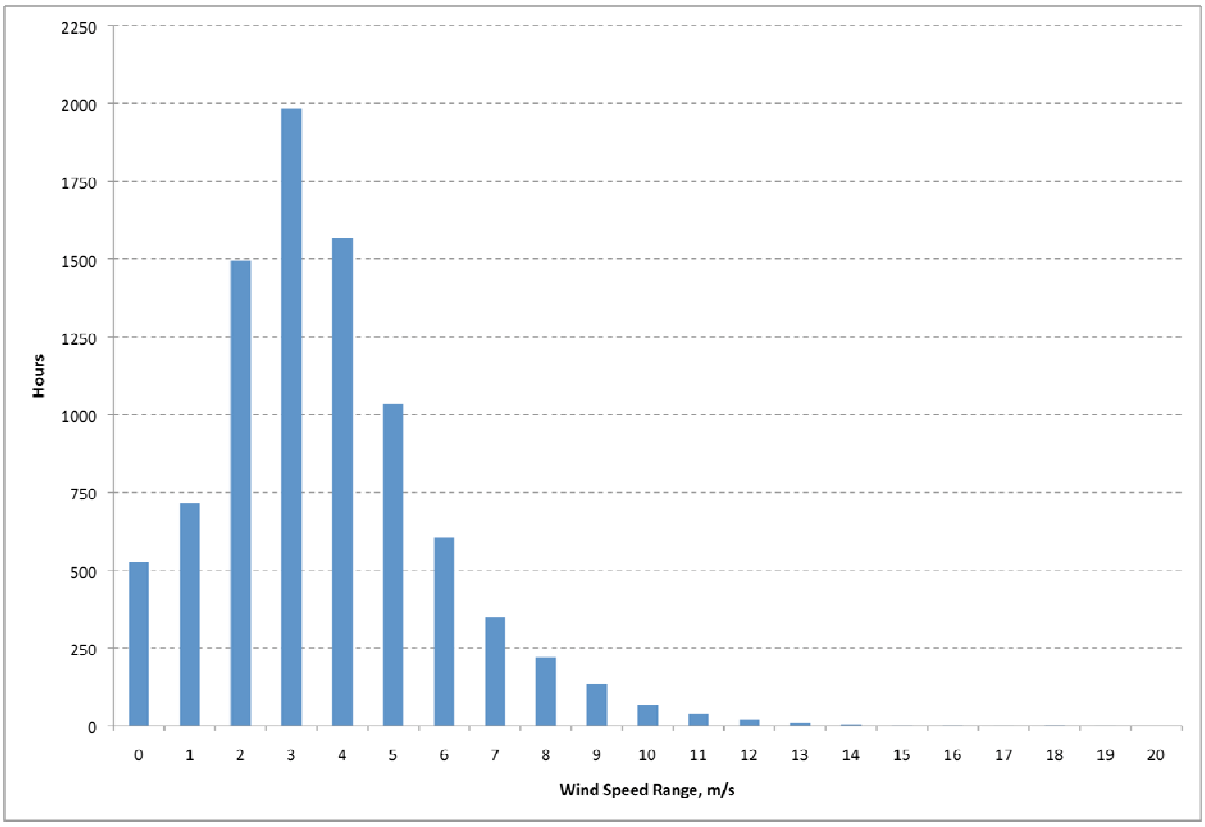

Figure 8: Wind Speed Distribution at Ocean Gate at 50 meters

Table 6: Wind Speed Data at Ocean Gate at 50 meters

Speed Range, m/s	Hours
<1	524.6
1-2	714.3
2-3	1492.4
3-4	1979.3
4-5	1564.8
5-6	1032.2
6-7	604.0
7-8	347.7
8-9	220.6
9-10	134.9
10-11	66.4
11-12	39.6
12-13	18.3
13-14	9.5
14-15	4.7
15-16	1.3
16-17	1.5
17-18	1.0
18-19	1.8
19-20	1.0
>20	0.0
Average Speed, m/s	**4.6**

Figure 9: Tower Installation at Ocean Gate

Supporting Small and Community Scale Wind Outreach

Under the second provision of the grant, to support small and community scale wind outreach, Rowan University proposed to promote and educate public officials on how best to support and deploy wind energy systems in their respective community. This outreach and education, in the form of a symposium, was held at Rowan University on August 11th, 2008. Flyers to promote the symposium were sent to all municipalities within the state. A copy of the symposium flyer is shown in Figure 10, as well as the symposium agenda in Figure 11. As shown, topics discussed included site assessment, the model ordinance, rebates/incentives, basics of wind energy, etc. Overall, the symposium was a great success with over 40 registered attendants from across local

government throughout the state. A list of registered attendants is shown in Table 7. In addition to the New Jersey Board of Public Utility's Office of Clean Energy, five external sponsors - Fisherman's Energy, Island Wind, Green Words, Bergey Wind Power, and Alternative Energy Associates – supported the event.

Figure 10: Symposium Flyer

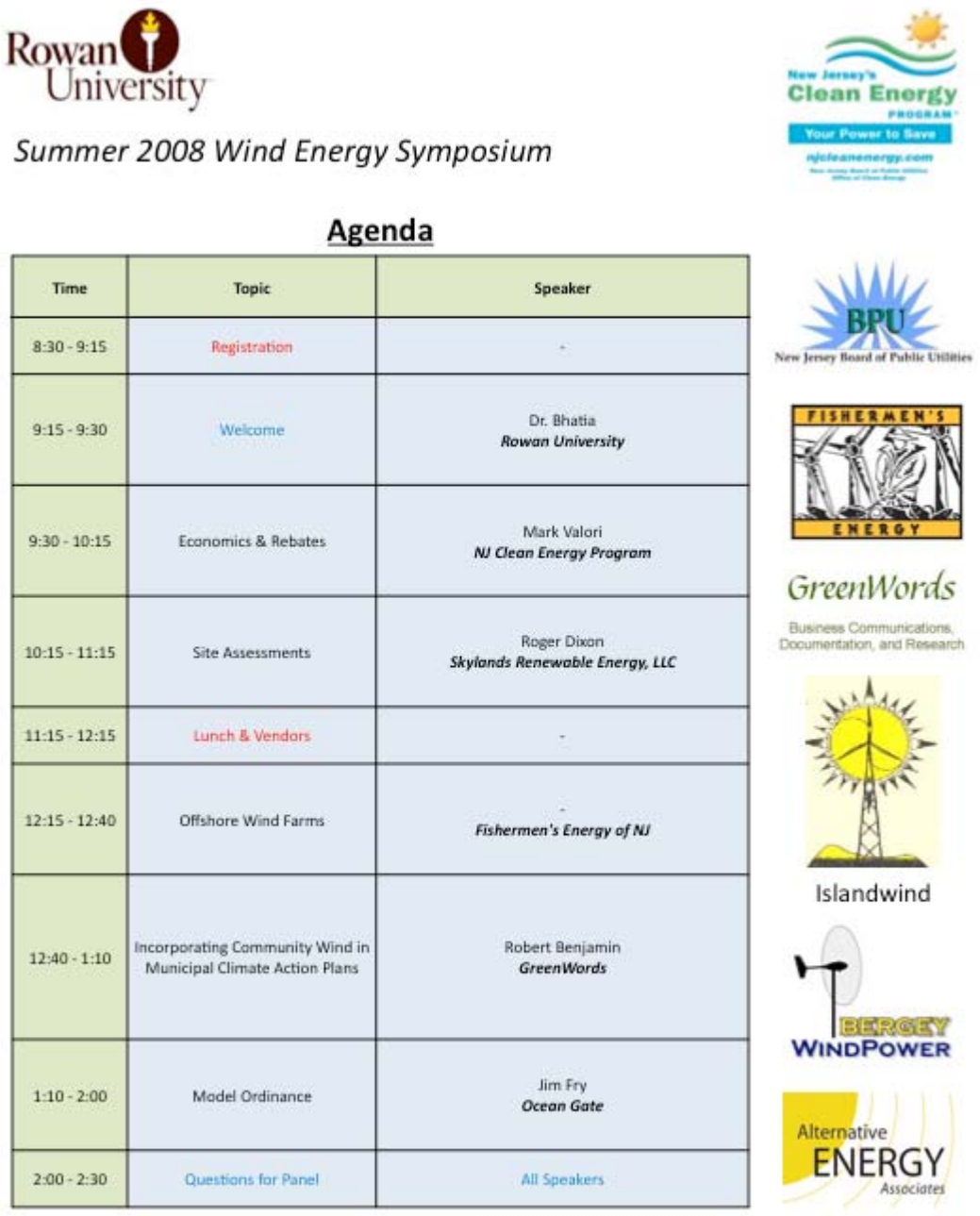

Figure 11: Symposium Agenda

Table 7: Symposium Registered Attendants

	Name	Location	Email	Phone
1	David Thompson	Ewing, NJ	dwthompson@ewingtwp.com	
2	Dan Udovic, P.E.	Wall Township, NJ	dju@pi-domains.com	732-682-0415
3	John Hoffman, P.P.	Wall Township, NJ	jhoffmann@townshipofwall.com	
4	Ken Mosca	Ocean Township, NJ	administrator@townshipofocean.org	
5	Dale Goodreau	Egg Harbor Township, NJ	dgoodreau@ehtgov.org	609-926-4027
6	Environmental Commission Member	Egg Harbor Township, NJ		
7	Juan Bellu	Brick Township, NJ	jbellu@twp.brick.nj.us	732-262-1053
8	Lou Ianniello	Brick Township, NJ	chaser3259@aol.com	
9	Tom Brys	Brick Township, NJ	tbrys@pmkgroup.com	
10	Peter Boughton	Ewing, NJ	peter.boughton@dep.state.nj.us	609-292-0655
			petejbo742@aol.com	609-771-9173
11	Bonnie Flynn	Stafford Township, NJ	bonnie.flynn@twp.stafford.nj.us	609-597-1000 ext. 8529
12	Brian Grant	Asbury Park, NJ	brian.grant@cityofasburypark.com	732-502-5713
13	Barbara Suchecki	Avon by the Sea, NJ	grantcoord@optonline.net	732-502-4510
14	Steve Komsa	Beachwood Borough, NJ	stevekomsa@comcast.net	
15	Mark Loeser	NJ Clean Energy Program	mark.loeser@veic-nj.org	732-218-4430
16	Larry Barth	NJ Clean Energy Program	larry.barth@veic-nj.org	
17	Mark Valori	NJ Clean Energy Program	mark.valori@csgrp.com	732-218-3411
18	Lisa Grega	The College of NJ	grega@tcnj.edu	609-771-2860
19	Tait Chirenje	Stockton College	tait.chirenje@stockton.edu	352-514-6379
20	Patrick Hossay	Stockton College	patrick.hossay@stockton.edu	
21	Chris McFarland	Ocean County College	cmcfarland@ocean.edu	732-255-0400 x 2994
22	Leslie London	Franklin Township, NJ	llondon@mandslaw.com	973-622-1800
23	Jim Rutala	Ocean City, NJ	jrutala@ocnj.us	609-525-9333
24	Elizabeth Terenik	Ocean City, NJ		
25	Benjamin Scott Hunter	NJBPU	alma.rivera@bpu.state.nj.us	973-648-7405
26	Alma Rivera	NJBPU		
27	Stephanie Cook	Somers Point, NJ	stephanie.cook@somerspoint-nj.com	609-927-9088 x 136
28	Lynn Stiles	Stockton College	lynn.stiles@stockton.edu	609-652-4299
29	Paul Dietrich	Upper Township, NJ	engineer@uppertownship.com	609-628-2011 x 244
30	Charles Wimberg	Atlantic City Electric	debbie.lucca@atlanticcityelectric.com	609-625-5983
31	Lee Horan	Borough of Lavallette, NJ	leroyh9802@aol.com	732-267-6903
32	Roger Dixon	Skylands Renewable Energy, LLC	roger.dixon@att.net	
33	Jim Fry	Ocean Gate	JFryOG@aol.com	
34	Robert Benjamin	Green Words	robert.benjamin@greenwords.net	
35	Frank DeWitt	Alternative Energy Associates		
36	-	Fishermen's Energy of NJ		
37	-	Fishermen's Energy of NJ		
38	Michael Mercurio	Islandwind		
39	Timothy Carew	Northfield, NJ	tcarew@ibew351.org	609-704-8351
44	Seth Schultz	The Louis Berger Group	sschultz@louisberger.com	917-715-5731
45	Mina Bounkhay	The Louis Berger Group	mbounkhay@louisberger.com	

Analysis of Current New Jersey Small Wind Model Ordinance (NJMO)

Under the final provision of the grant, Rowan University performed an analysis of the current NJMO and compared it to ordinances passed throughout the state as well as model ordinances (MOs) in other states. The goal of this analysis was to make suggestions for changes in the model zoning ordinance to help facilitate its development for consideration in individual municipalities through the state with as minimal modification as possible by the locality. Within the state of New Jersey, the following townships have recently adopted ordinances regarding small wind power:

Oldmans
Brick
Galloway
Hillsboro
Ocean Gate

In addition to these five, MOs developed by wind working groups in seven states throughout the nation were analyzed. These states included:

Maryland
Massachusetts
Minnesota
New Hampshire
North Carolina
Pennsylvania
Wisconsin

To analyze the current state of the NJSWMO, it was decided to address each topic laid out in sections 00.05 through 00.08 of the ordinance and assess it relative to other ordinances. Sections 00.01 through 00.04 were bypassed as they deal with issues such as title, authority, purpose, and definitions. However, a brief analysis will be given of Section 00.01's definition of a small wind system as this does vary significantly from one state's MO to another's. Furthermore, sections 00.09 through 00.12 were bypassed in this analysis as they deal with issues of enforcement, administration, violations, and penalties. For each section analyzed, a brief summary is presented of the NJMO as well as a discussion of how other model and/or implemented ordinances address the issue, if significantly different than the method used in the NJMO.

Section 00.01 – Definition

Section 00.01 of the NJMO defines several of the terms used throughout the ordinance. Differences between these definitions and those used in other state's MOs, for the most part, are minor grammatical variations. However, during the analysis of various ordinances, it was found that the definition of a "small wind system" did have variation. In the NJMO, a small wind system is defined as one of less than 100 kW capacity. Furthermore, the NJMO allows the municipality flexibility in inserting their own height requirements for various applications (residential, commercial, industrial, and agricultural). While Maryland's and Wisconsin's MOs uses a similar definition, Massachusetts utilized a 60kW limit. North Carolina utilized a three tier definition (small less than 20kW, medium between 20 and 100kW, and large greater than 100kW). Minnesota utilizes a commercial vs. non-commercial definition as well as allows for a micro wind energy conversion system category for those systems less than 1kW in capacity and shorter than 40ft in support tower height.

Section 00.05 – Standards

1. Setbacks – In summary, the NJMO setbacks standard states that "A wind tower for a small wind energy system shall be set back a distance equal to the town's building set back requirements." For all other state MOs, specific minimum setbacks are provided. These varied from 100% to 150% of the total tower tip height. Within the ordinance passed in Oldmans Township, NJ, a specific setback of 130% was listed. A more flexible NJMO could include space for the township to enter their local setback requirements within the ordinance.
In addition, several state MOs included provisions for setback waiver.

2. Access – In summary, the NJMO requires securing and labeling of all

electrical/control equipment as well as accessibility requirements regarding, minimum step ladder height, etc, to prevent unauthorized tower climbing and access. Most other state MOs or local ordinances, except for Wisconsin's MO, do not address this issue or address it in a very minimal way in regards to secured electrical connections and locked control boxes. However, several state MOs do include provisions relating to the establishment of a safe access road to site incase of fire and/or medical emergency at the tower location.

3. Lighting - The NJMO sates the "A small wind energy system shall not be artificially lighted unless such lighting is required by the Federal Aviation Administration." This requirement appears to be universal among all other MOs analyzed.

4. Appearance, Color, and Finish – In summary, the NJMO requires the tower to keeps it original manufactured color/finish unless otherwise approved during the zoning process. Several other state MOs, namely Massachusetts, Pennsylvania, Minnesota, and North Carolina, require or suggest a "non-obtrusive" color such as white, off-white, or gray. In this regard, the NJMO seems to be much more flexible than others. Regarding appearance, most local ordinances in the state simply require the tower be kept in good condition while most state's MOs rarely address the issue.

5. Signs – In summary, the NJMO states that only original equipment manufacturer signs, identification signs, and/or warning signs should be used. Most other state's MOs address the issue in a similar fashion. Of exception is Massachusetts' MO which allows the use of educational signs about the facility as well as promoting the benefits of wind power.

6. Utility notification and interconnection – The NJMO sates that "Small wind energy systems that connect to the electric utility shall comply with the New Jersey's Net Metering and Interconnection Standards for Class I Renewable Energy Systems at N.J.A.C. 14:4-9." Most state's MOs use similar language although two (Pennsylvania and New Hampshire) do not directly address the issue.

7. Met towers – The NMO requires similar permitting and requirements for a meteorological tower as a wind turbine. This approach is used in most other state's MOs. Some state's accomplish the same goal by using and inclusive definition of a "wind energy facility" as any turbine or met tower.

Section 00.06 - Permit Requirements

In summary, the NJMO requires a zoning permit for installation of a small wind system. It outlines the necessary documents/information needed with the permit application (site dimensions, site location, wind energy system specifications, location of roads, utility lines, etc) as well as requires payment of all necessary permit fees. In addition, it allows a 24 month period for installation of the system before expiration of the permit. Other state's MOs follow a similar procedure with a few minor differences. Pennsylvania's is more detailed in terms of the materials required during the permit application process, but this may not be necessary. Furthermore, Pennsylvania allows the municipality to insert the exact fee amounts into the model ordinance document. In addition, several states (North Carolina and Minnesota for

example) establish variations in the permitting procedure and requirement depending on if the wind energy system is being proposed for a residential, commercial, agricultural, or industrial site.

00.07 – Abandonment

The NJMO essentially defines abandonment as a continuous 18 month period, requires a notice to be sent to the owner, recognizes the owner's right to respond within 30 days of the notice, and finally allows the owner 6 months to remove the abandoned tower before the locality could exercise the option of legal pursuit. Other state's MOs approach the issue of abandonment in a very similar fashion, although the definition of abandonment is typically 12 months rather than the NJMO's 18 month definition. Other slight differences exist in the timeline for notification and allowed time for tower removal.

Section 00.08 - Zoning Permit Procedure

The NJMO lays out a straightforward timeline and procedure for the permit process. Most other state's MOs combine this with the permit requirements section of the ordinance (i.e. combining sections 00.06 and 00.08) but this is of minor organizational concern. Although having a timeline is more specific, a few states (North Carolina and Minnesota for example) do not include any timeline in their MO.

Sound Issues

Although not included in the NJMO, several other states' MOs (New Hampshire, Pennsylvania, Maryland, and Minnesota) addressed noise concerns. All established limits between 50 and 55 dBA, as measured at the property line.