

Linda Wetzel

From: Bachmann, Joanne <Joanne.Bachmann@csgroup.com>
Sent: Wednesday, November 02, 2011 7:39 AM
To: Linda Wetzel
Subject: FW: Wind Studies

Joanne Bachmann
Renewable Energy Account Manager
VEIC
732-218-4430

From: Tal Mamo [<mailto:tmamo@talco.com>]
Sent: Wednesday, October 26, 2011 5:11 PM
To: publiccommentswind@njcleanenergy.com
Subject: Wind Studies

To Whom It May Concern,

Talco Electronics is a National Distributor of small wind turbines and has several installers and projects in NJ. NJ is proposing to pay a small wind rebate based on estimated performance of wind turbines. NJ is reviewing solutions to provide accurate, cost effective and consistent estimated wind energy production results to NJ residents and businesses applying for this rebate.

We strongly recommend NJ to take a close look at Wind Analytics who has developed the appropriate solution for NJ in this regard, it would probably make sense for the State to review the Wind Analytics estimated wind energy reporting software as an option for the State to reach its goals most effectively.

Two key features of Wind Analytics are (i) 3rd party analysis which removes inherent bias from results, and (ii) the application of logarithmic law for estimating wind speeds for customer-sited wind vs. power law. Power law which is currently employed by AWS, 3 Tier, and Cadmus Group has been discredited in peer reviewed papers for poorly estimating wind speeds below 40m.

Thanks,

Tal Mamo
President
TALCO Electronics
T: [858-225-6442](tel:858-225-6442)
F: [858-444-1780](tel:858-444-1780)

Linda Wetzel

From: Bachmann, Joanne <Joanne.Bachmann@csgroup.com>
Sent: Wednesday, November 02, 2011 7:39 AM
To: Linda Wetzel
Subject: FW: Estimating wind speed for wind turbine performance
Attachments: Wind Analytics Methodology.pdf

Joanne Bachmann
Renewable Energy Account Manager
VEIC
732-218-4430

From: Russell Tencer [<mailto:RTencer@windanalytics.com>]
Sent: Tuesday, October 18, 2011 12:04 PM
To: publiccommentswind@njcleanenergy.com
Subject: Estimating wind speed for wind turbine performance

To Whom It May Concern,

NJ is proposing to pay a small wind rebate based on estimated performance of wind turbines. NJ is reviewing solutions to provide accurate, cost effective and consistent estimated wind energy production results to NJ residents and businesses applying for this rebate.

Wind Analytics has developed the appropriate solution for NJ in this regard, it would probably make sense for the State to review the Wind Analytics estimated wind energy reporting software as an option for the State to reach its goals most effectively.

Two key features of Wind Analytics are (i) 3rd party analysis which removes inherent bias from results, and (ii) the application of logarithmic law for estimating wind speeds for customer-sited wind vs. power law. Power law which is currently employed by AWS, 3 Tier, and Cadmus Group has been discredited in peer reviewed papers for poorly estimating wind speeds below 40m.

I am happy to set a Webex or in person demo for your review.

Thank you for your consideration,
Russell

Russell Tencer
CEO | Wind Analytics
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Brooklyn, NY 11201
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THE WIND ANALYTICS™ METHODOLOGY



The New Standard For Estimating Customer-Sited Wind Turbine Performance

Wind Analytics patent-pending methodology for estimating wind turbine performance is the only system designed specifically for customer-sited wind turbines, and now it's available globally. Stop wasting time and money with wind maps or anemometers and get the wind data you can rely on.

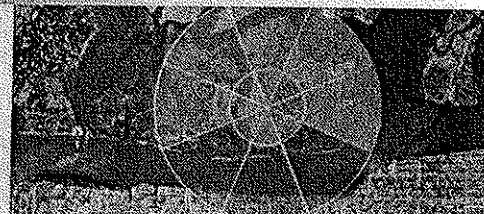
1. GLOBAL LONG TERM WIND DATA

Leveraging our customized global database of over 28,000 meteorological stations, Wind Analytics uses long term wind speed and directional data local to your property as inputs to our wind energy model. These observations are corrected for errors and land cover effects, then interpolated to a point directly above the proposed wind turbine location.



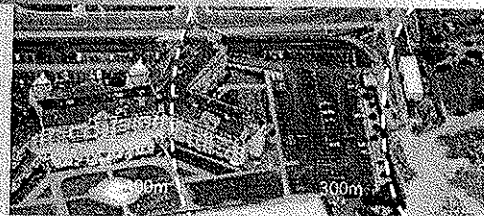
2. LOCAL LAND COVER EFFECTS ANALYZED

As wind approaches a prospective wind turbine location, it is influenced by topographical and land cover effects. A Wind Analyst will classify the land cover up to 2 miles around the location in 8 directions and 2 distances for a total of 16 site specific inputs. Since land cover is always changing, Wind Analytics is designed to account for changes in land cover around the location.



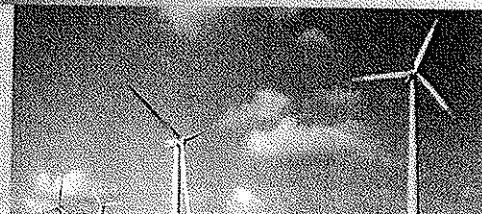
3. TREES, STRUCTURES, AND OTHER SURFACE FEATURES MODELED

Trees, structures, and other topographical features can greatly affect wind flow. It is essential to accurately account for these effects in order to correctly estimate energy output of a wind turbine. To correctly account for these effects, Wind Analytics employs 3 dimensional vegetation, topographical, and structural wake modeling for all relevant obstructions up to 1/2 mile around a proposed turbine.



4. UP TO 3 TURBINES COMPARED AT OPTIMAL LOCATION

After wind energy is determined at various potential points on a property, the optimal point is selected by a Wind Analyst. The next step is to compare different certified turbine power curves and installed costs to determine the best fit for a project. Since wind turbine performance can vary significantly from point to point, Wind Analytics is there to determine the optimal scenario.



5. CUSTOM ECONOMIC MODELING AND FINANCIAL METRICS

In order to understand the value of a prospective wind turbine project, it is essential to properly account for all of the variables. Wind Analytics starts with wind turbine performance, then layers other economic factors including installed cost based on local pricing, power prices, tax incentives, and available rebates to accurately determine project payback and other important financial metrics.



From: Roger Dixon <roger.dixon@att.net>
Sent: Friday, October 28, 2011 9:25 AM
To: publiccommentswind@njcleanenergy.com
Cc: 'Hunter, B'; 'Winka, Michael'; 'Damiani, David'; 'Bachmann, Joanne'
Subject: Suggestions to Amend the Proposed 2012 REIP Draft Change

Firstly, I would like to thank all those involved for the time and effort that has been put forth in an attempt to revise and improve the current NJ BPU REIP funding program for wind turbines.

Secondly, I would like to note a few particular items in regard to the proposed changes:

1. NRTL Certification for all wind turbines until they acquire SWCC or similar certification. As I had noted during the last NJSWWG meeting and also on prior occasions, the 2011 NEC (National Electric Code) has a section, Article 694, that addresses small wind turbines up to and including 100 kW. It notes what is appropriate and needed for certification under the National Electric Code. It was specifically written by a committee of small wind turbine stakeholders, presented to and accepted by the NEC. If you would like additional information, please contact Rob Wills, committee co-chair, (rwills@intergrid.org) or Robert Preus, committee co-chair, (robert@ARTre.us). The NJ DCA still uses the 2008 NEC Code. I do not know what is involved to adopt the current 2011 NEC code, but if the NJ DCA would do so, there would be no need for NRTL certification for any wind turbine up to and including a 100 kW turbine. This will save project dollars, as well as lessening project timelines due to NRTL certifications, which I understand will take 3-6 months or more. It will also help to eliminate some of the associated frustrations that potential wind turbine owners incur and influence their decisions to not move forward with a project.
2. A NRTL certification is noted as being in the range of \$3000-\$25,000. If we assume a typical residential installation in the neighborhood of \$100,000 this adds anywhere from 3% to 25% to the overall project cost.
3. I believe the proposed insurance requirements are appropriate. However, I would like to point out both of the Forked River wind turbine projects carried this level of insurance coverage by both the manufacturer and the installer. There is no insurance coverage for a client that decides he no longer wants his wind turbine.
4. Warranty requirements. I concur with the comments made during the NJ SWWG meeting in that NJ should follow NYSEERDA's lead and require the manufacturer to back up the dealer if the dealer should go out of business. However, I do not agree that the liability for the BPU mandated 5 year warranty should ride solely on the dealer/installer's shoulders. If any part of the manufactured system is defective it is beyond the installer's ability to control. Installers are responsible for the installation and commissioning of the equipment and system and as such, have no control over the quality of any given wind turbine system or wind turbine part that a manufacturer ships. Nor are installers responsible for the engineering of those parts, or the failure of those parts. The

responsibility for these types of issues lies with the manufacturer. A new part must be obtained from the manufacturer and only then can the installer replace the defective part by installing the new one. Manufacturer's warranties run the full gamut from covering almost nothing, to supplying parts, shipping and paying for the labor to install them. If the NJ BPU truly wants an inclusive 5 year warranty, then the installer *and* the manufacturer should be responsible for taking the appropriate steps that fall within their purview to repair and/or replace defective system parts.

5. We are being asked to accept the use of the Cadmus DSAT wind site analysis calculator/tool. Although I participated in a DSAT webinar a couple of months ago, I have yet to use the tool myself and while I think this particular calculator appears to be a good choice, it has yet to be released and is currently unavailable to the public. I do find the \$300/year fee to be quite reasonable and it should not present an issue for anyone that is working in the industry. However, it is difficult at best to endorse something that isn't yet available for use and review and has not yet been proven.
6. Rebate payment structure. I do not think a rebate structure of 50% to be paid after the installation and all final inspections are completed and 50% to be paid after 12 months, based on the actual last 12 month's production, is a viable funding model. History has proven that this type of funding will impair, if not collapse, the small and medium size wind turbine markets. (Massachusetts presents in this fashion). Most residential and many farm and commercial wind turbine projects are financially strained by waiting for the installation and final inspections to be completed under the current REIP, typically 60 days or more from the completion of all final inspections. Additionally, many homeowners, farmers and smaller commercial businesses will need to borrow at least some portion of the project funding. What institution will lend money based on a REIP payment used as collateral that is a variable, non-guaranteed amount? The proposed payment structure will only exacerbate the project financials, as well as restrict and impair the growth of the market.
7. An additional point of note is the fact that the wind resource itself will vary as much as 50% from year to year, so the actual production during a "low wind" preceding 12 months would be unfair to the applicant and the actual production during a "high wind" preceding 12 months would not be prudent either. (See item #9 below as well).
8. Rebate payment calculations. Here again, I do not think the reduction in the current funding amount is appropriate, nor helpful, to furthering the development of the small wind market in NJ. The proposed changes will reduce the maximum base amount by \$6200, which is 14% less than the prior maximum base amount. In addition, the proposal also reduces the maximum production by 1000 kWh's. If we go back to the numbers in item # 2, we now have the following example:
 1. Additional cost for NRTL = + 3%-25%
 2. Reduced REIP payment = - 14%
 3. Total additional cost = + 17% - + 39% for a \$100,000 residential project with a minimum of 14% less.

I understand the incentive to reward a project with a better wind resource, but I also question the proposed 13.4 mph target for that. As we know, there are not too many areas

in NJ that have this average annual wind speed or better. Some of the ridge top areas in Northern/Northwestern NJ, along with the Jersey coastline would basically cover those areas. Unfortunately, approximately 75%-80% of those areas are along our coastline, which is currently under NJ DEP restrictions for wind turbines, especially those that are approximately 40-50 kW or larger. I question how many projects will actually be built in these restricted areas and be able to take advantage of the additional funding.

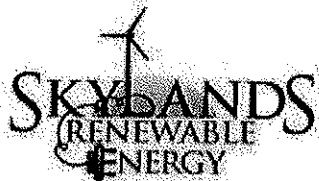
I would suggest the NJ BPU look again, in part, to what NYSEERDA currently offers in this regard. Their funding is based on estimated annual production using a calculator, similar to NJ's program, at \$3.50/kWh. It is paid in two parts, 65% after delivery of the equipment and 35% after commissioning and final inspections are completed, and it is paid only to the installer. This incentivizes the installer to complete the project in a timely fashion and it also avoids final payment abuse by customers. More information is available here; <http://www.powernaturally.org/programs/wind/incentives.asp>.

9. When asked during the last NJSWWG meeting, Mark Mayhew (who manages NYSEERDA's small wind program), stated that NYSEERDA currently experiences an approximate 20% swing in the comparison of estimated output and actual wind turbine performance. He seemed to indicate that this was an acceptable level of variance. Although we would all like to be able to predict the estimated output as closely as possible, we also need to understand that the wind resource will vary as much as 50% or more from year to year. It only makes sense to accept that variability will be seen and should be expected. A program that reflects an acceptable level of variability, rather than a near perfect estimate of annual production, would be a worthy target.

Due to my current out of state installation schedule and a condensed timeline for responses, I am willing to make myself available in the future discuss any of these points if desired.

Thank you,

Roger Dixon
Skylands Renewable Energy, LLC
MREA Certified Wind Site Assessor
NABCEP Certified Level 3 Small Wind Installer
ASME/IACET Certified Rigging Instructor
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Linda Wetzel

From: Bachmann, Joanne <Joanne.Bachmann@csgroup.com>
Sent: Wednesday, November 02, 2011 7:39 AM
To: Linda Wetzel
Subject: FW: Presentations for the Small Wind Working Group - Tuesday Oct. 18 - 9:30am - 12:30pm

Joanne Bachmann
Renewable Energy Account Manager
VEIC
732-218-4430

From: John Simon [mailto:jsimon@seaforthenergy.com]
Sent: Thursday, October 20, 2011 4:32 PM
To: Bachmann, Joanne; publiccommentwind@njcleanenergy.com
Subject: RE: Presentations for the Small Wind Working Group - Tuesday Oct. 18 - 9:30am - 12:30pm

First of all let me say I applaud the efforts of NJCEP Working group to deal with this issue. It is critical for manufacturers and the public that turbines are independently certified by accredited institutions. We have reviewed your recommendations and have the following comments:

1. Certification - What is meant by the requirement for turbines under 200m² swept area to be certified vs those over to be "type" certified? Seems to imply a lesser degree of standard for turbines which are actually larger?
2. Field Listings are a challenging option to manage – Firstly site inspections will be subject to interpretations and grey areas that will raise questions by those manufacturers that have completed the proper testing. They also put the public at increased risk. To that point, any legitimate manufacturer should have completed significant independent 3rd party tests prior to making their turbine available to the market. A field listing approach encourages them to skip this required diligence before launching their product.

At the basic level, any turbine being offered to the market should have completed testing by an independent 3rd party accredited testing institution. Results from manufacturer test sites or unaccredited locations should not be permitted.

John Simon
Vice President
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Linda Wetzel

From: Heather Rhoads-Weaver <heather@eformative.net>
Sent: Tuesday, November 01, 2011 5:01 PM
To: 'publiccommentswind@njcleanenergy.com'
Cc: Mike Bergey; 'Jennifer Jenkins'
Subject: Recommendation on REIP for Wind

As a follow-up on the comments submitted by the Distributed Wind Energy Association last week, I'd like to recommend that BPU consider issuing a solicitation to investigate options for wind resource characterization and performance analysis tools, similar to that recently issued by the Energy Trust of Oregon: http://energytrust.org/library/RFPs/RFP_Energy_Trust_Wind_Analysis_Solution.pdf, while the program comes back online.

A competitive bid process accepting proposals from multiple solution providers is a good way to understand which performance/payback estimation system would be most accurate for the state of NJ.

Thanks for your consideration,

Heather E. Rhoads-Weaver
DWEA Board Member

eFormative Options, LLC
...forming & advancing sustainable endeavors
206.567.5466 / cell 206.755.2064 / efax 206.260.3469
hrw@eformativeoptions.com

Memo

To: BPU/NJCEP/SWWG, Joanne Bachmann, publiccommentswind@njcleanenergy.com
From: Turbine Advantage, Peter Wright, 732-245-8876, peter@turbineAdvantage.com
Date: October 25, 2011
Re: 2012 REIP for wind systems

We attended the excellent meeting on October 18, 2011. Joanne Bachmann, David Damiani, Scott Hunter and Charlie Garrison covered a huge amount of material on schedule and managed all input very comfortably.

We respectfully submit our thoughts on the draft.

First, REIP for wind systems should remain an important part on BPU's work toward the Master Plan and toward its overall mission. We cannot succeed in New Jersey without providing for the future of our energy needs. That means investigating and encouraging alternatives in a budgeted, controlled fashion.

The new plan limits the benefits of participating in REIP while increasing the costs; both in time and in fees. We fully sympathize with the need for OCE and BPU to protect customers, ratepayers and themselves. However, we feel that only a policy that is affordable, predictable, understandable and sufficient in duration to bridge the permitting time frame will really incentivize wind systems.

However, as Scott Hunter suggested I will not waste time poking holes in the draft. Instead, I will present my suggestions to make the incentives for wind work for New Jersey.

I suggest that New Jersey need not reinvent the wheel on certification and permitting. All of these concerns are adequately addressed by existing or future certifications by IEC or SWCC and/or local permitting bodies. Enough is enough. Your mission should be to incentivize renewable energy not to kill it. All of the needed safety regulations, checks and balances are in place already. I suspect that the accident investigations will confirm that additional precautions are not necessary and will not help. However, if there is a need, there could be indemnification of BPU by manufacturers and installers.

In short, the additional burden of new compliance requirements will create a huge cost to the customers and the industry with no benefit, in my opinion. There is not a need for additional certifications, permits, fees or inspections.

Calculations for incentives that are based on models will always be a problem. The models are complex, challenging and interesting but do not bear sufficient accuracy to be the core of an incentives plan. They consume time, resources and energy that can be better utilized in other ways. Wind is too variable a resource to be captured by a model. We are on the verge of newly adopted certification standards. There is sufficient consistency in these standards to allow the results of their tests to replace the modeling of estimated production, entirely. I suggest that rated capacity might be the benchmark. California wind subsidies got in trouble for many reasons. However, I feel that their system of paying \$3 per rated Kw is a workable starting point.

However, this will only work in conjunction with one or two other changes. All production must be metered and reported. Here is an opportunity to redirect time not spent on modeling. Reported production should be publicized to foster the most efficient form of educating the industry and consumers about the potential for harnessing the wind in New Jersey.

The incentive will be paid at the time of interconnection approval and inspection. However, the incentive will be in the form of a loan; not a grant. This loan will be guaranteed by the purchaser and/or the manufacturer. It will be interest free for up to two years. The loan will be forgiven in four installments based upon metered production. To accommodate variations in the annual wind resource the owner may use either the energy production quarter by quarter from year one or year two to surpass his production quota and earn that quarters loan forgiveness. This process places the burden back on the customer and installer to site their turbines well.

OCE will accept the applicant's production estimates as the basis for their incentive. OCE will need to exercise diligence to weed out gross errors in estimation. However, since the customer will be on the hook for the loan, there is hope that this system will have a strong element of self policing.

Finally, New Jersey has an enormous opportunity to incentivize wind and do it on a budget. The permitting burden on New Jersey residents and businesses is no longer acceptable, if it ever was. We can change that, now. The cities of Washington, DC, Philadelphia and Houston have shown us how. We can preserve home rule and make changes, now, to get New Jersey out of the basement of business unfriendliness by overhauling the local permitting process. This can have all of the impact of a tax cut. This idea will be presented in detail to the Lieutenant Governor's Office, Tracye McDaniel of ChooseNJ and the Department of Community Affairs.



Small Wind Certification Council
56 Clifton Country Road, Suite 202
Clifton Park, NY 12065
info@smallwindcertification.org

October 28, 2011

B. Scott Hunter
Renewable Energy Program Administrator
Office of Clean Energy
New Jersey Board of Public Utilities
44 S. Clinton Ave., POB 350
Trenton, NJ 08625-0350
publiccommentswind@njcleanenergy.com

RE: SWCC Comments on REIP for Wind Recommended Program Changes

Dear Mr. Hunter,

This letter and attachment encompass comments from the Small Wind Certification Council (SWCC) concerning the proposed draft changes for the Renewable Energy Incentive Program under consideration by the New Jersey Board of Public Utilities, including recommendations for clarifying incentive eligibility.

In addition, we would suggest that your staff review Appendix C (pages 47-49) of the Revisions to the Emerging Renewables Program Guidebook scheduled for consideration of adoption by the California Energy Commission on November 2, 2011:
<http://www.energy.ca.gov/2011publications/CEC-300-2011-004/CEC-300-2011-004-D3.pdf>

SWCC applauds the proposal requiring small wind turbines to be certified by an independent certification body in order to receive incentive funding and affirming REIP's right to remove turbines from eligibility at staff discretion. In addition to the concerns listed, staff should consider the quality of data presented for purposes of equipment eligibility, experience with manufacturer support for equipment maintenance and warranties, and interviews with owners/operators of other retail installations in North America.

These important program changes will promote confidence that small wind turbines installed under REIP have been tested for safety, function, performance and durability, and will ensure consistency in ratings.

However, we recommend a few additional revisions and clarifications to ensure a smooth relaunch of the program:

- 1) More clearly define the two options for eligibility: either full certification OR power curve certification together with "field listing" of each individual small wind turbine installed.

- 2) Explicitly state that turbine models with only SWCC "Conditional Temporary Certification" status and others certified under UK's Microgeneration Certification Scheme need to have their power performance confirmed by SWCC or a NRTL in order to qualify as power curve certified.
- 3) Establish a date such as June 30, 2012 for requiring full certification for small turbines within the scope of AWEA 9.1-2009.

Specific wording suggestions for the program requirements are attached.

SWCC has been operational and able to accept certification applications since February 2010. SWCC's fee structure and staffing has been established to allow rapid ramp-up in the event that numerous applications are received within a short period of time. SWCC does not anticipate delays in review of complete certification applications; decisions are expected within 2-4 months after submission of test reports and a full application.

Wisconsin's Focus on Energy and the Energy Trust of Oregon have both established requirements for independent certification for small wind turbines to qualify for incentives beginning January 1, 2012, and the New York State Energy Research & Development Authority has announced it will require full certification to the AWEA 9.1 standard as of September 30, 2012, in order for a turbine with a rotor swept area of less than 200 m² to be eligible for funding. A grace period of 6-9 months is ample for converting conditional or limited power performance certifications to full certification status.

The link between the small wind market and state and utility incentives and rebates is more apparent than ever, and SWCC appreciates BPU's recognition of the urgency of requiring certification to safety and performance standards. Rebate applications based on substantially inflated performance or reliability claims should not be awarded, so that valuable ratepayer funding can be made available to products with dependable performance estimates and demonstrated compliance with safety standards to aid customer satisfaction and adoption of small wind technology.

Please feel free to contact us with any questions or for further information. We are happy to continue working with BPU staff to ensure that certification requirements for New Jersey small wind incentives are appropriate, independent and rigorous. Thank you for your consideration.

Sincerely,



Brent Summerville
Technical Director

Attachment: SWCC Recommended Language for Incentive Eligibility

SWCC Recommended Language for New Jersey Small Wind Incentive Eligibility

In order to promote confidence that small wind turbines installed with ratepayer assistance have been adequately tested for safety, function, performance and durability and to ensure consistency in ratings, SWCC recommends the following revisions to the proposed draft eligibility requirements.

For a turbine to be eligible for an REIP rebate, a wind turbine manufacturer or authorized designee must provide technical information and specifications of the wind turbine model for BPU review and provide acceptable evidence demonstrating its safety, functionality and reliability through one of the following methods:

- 1) For small turbines with a swept area of 200 square meters or less and within the scope of IEC-61400-2 or the American Wind Energy Association Small Wind Turbine Performance and Safety Standard (AWEA 9.1- 2009), submission of either:
 - ⊖-a) Evidence of certification to IEC 61400-2 or AWEA 9.1-2009 by the Small Wind Certification Council (SWCC) or other independent certification body; OR
 - ⊖-b) Evidence that a power performance test conforming to AWEA 9.1-2009 or IEC 61400-12-1 has been certified by the SWCC or other Nationally Recognized Testing Lab (NRTL) or independent certification body. Turbine models certified under the UK's Microgeneration Certification Scheme,¹ including those that have achieved SWCC "Conditional Temporary Certification" status based on testing and analysis pursuant to the IEC 61400 Standards or the BWEA Standard, would also need to achieve SWCC "Limited Power Performance Certification" or equivalent power performance certification confirmation by a NRTL.
- 2) For turbines with a swept area of more than 200 square meters and therefore outside the scope of IEC 61400-2 or AWEA 9.1-2009, submission of either:
 - ⊖-a) Evidence of type certification by an entity that is accredited to provide product conformity certification to IEC Standard 61400-1, IEC Standard 61400-11 and IEC Standard 61400-12-1; OR
 - ⊖-b) Evidence that a power performance test conforming to IEC 61400-12-1 has been certified by a Nationally Recognized Testing Lab (NRTL) or independent certification body.

•-In addition, for turbines seeking eligibility under 1b or 2b above that have not yet been fully certified, the New Jersey Department of Community Affairs (DCA) has authorized local municipal inspectors to require small wind energy systems satisfy a "field listing" of the wind energy generating system. The "field listing" tests will be performed by a Nationally Recognized Testing Laboratory (NRTL) at the expense and arrangement of the installer, manufacturer, or customer. A list of NRTL's can be found at: <http://www.osha.gov/dts/otpc/nrtl/nrtllist.html>. For turbines that do not have certification, an installation can not pass the local inspection without a passed report from the NRTL. Eligibility under option 1b will no longer be offered after June 30, 2011.²

¹ www.microgenerationcertification.org/mcs-consumer/product-search.php

² Testing is complete or nearly complete for several wind turbine models and up to nine turbines from manufacturers representing a significant share of the North American small wind market are expected to be certified by Spring 2012. This deadline will encourage manufacturers to accelerate their efforts to complete full certification.

Linda Wetzel

From: Atkinson, Trevor <tatkinson@northernpower.com>
Sent: Friday, October 28, 2011 4:31 PM
To: publiccommentswind@njcleanenergy.com
Subject: BPU REIP Comments

Hello PSB,

Thanks again allowing feedback to the proposed program changes. Northern Power Systems builds a 100kW wind turbine so we fit into the changes under the greater than 200 sq. meters rotor category.

- * **Evidence of type certification by a certification body that is accredited to provide product conformity certification to IEC Standard 61400-1 (safety), IEC Standard 61400-11 (noise) & 61400-12-1 (performance)**

In principle, certification is fantastic, but asking for IEC type 61400-1 certification of small turbines, < 1-2 Mega Watt is almost never going to happen. This is a very, very expensive task and is just an unrealistic ask of any small turbine manufactures. I am not fully up to speed with the SWCC process because it is not applicable to the 100kW size machine, but that requirement for under 200 sq. meter rotors totally makes sense and is necessary to protect the innocent.

What is more typical and achievable is to require **3rd party independent testing to the IEC standards**. Responsible and legitimate manufactures have completed this already or are underway. This is the most effective way to protect the customer from farfetched, unrealistic and unattainable performance claims. The NJREIP should require formal reports and/or certificates stating compliance to 61400-11 and 61400-12-1 procedures and practices. We can provide (as reference) our 3rd party test reports if the REIP would like to see our evidence of compliance to these IEC standards.

For turbines not certified:

- * **The New Jersey Department of Community Affairs (DCA) has authorized local municipal inspectors to require a "field listing" of the wind energy generating system.**
- * **"Field listing" evaluations will be performed by a NRTL at the expense of the installer, manufacturer and or customer.**
 - * ***Installation will not pass a local inspection without a passed report***

We would suggest that if evidence/proof of independent 3rd party testing to IEC61400-11 and 61400-12-1 procedures and practices is **unavailable**, THEN "Field testing by NRTL" could be necessary. I believe that once a particular make and model has been "listed" other sites that are the same would not be necessary. I would suggest that any NRTL company contracted provide proof of conformance to IEC practices, procedures and data analysis. I really do not feel that NRTL testing will provide compliance to IEC61400-11 and 61400-12-1, and in most sites completing these tests will take weeks or months of data collection. The cost of this additional testing will be a significant burden and associated approval delay will radically hinder future projects.

DCA has verified to MM that the Field Listing requirement is effective immediately.

- * Focus includes:
 - * Review the installation's compliance with the NEC (National Electrical Code)
 - * Ensure each of the major components installed are UL listed by a UL certified testing facility.

This "Field Listing" requirement appears to be a compliance of electrical (UL & NEC) standards. Not sure how field Listing will protect customers from poor design and questionable energy and acoustic performance claims. Are any example Field Listing reports from other wind turbines available for review?

- * Confirm installation of ANSI C12 meter and anemometer
 - * Verify height and orientation of anemometer

Suggest changing the wording to "Local Utility approved" metering. As I understand it there are two C12 meters available, 0.5% and 0.2% accuracy. Which one is required? Don't the utilities provide the approved meters? That's the way many other states handle this.

Is the anemometer/tower expected to be permanent or temporary during the 12 month performance test period?

If the chosen wind turbine has its own anemometer wind speed logging sub-system, would that collected data be acceptable for validation of actual site wind resource? We have been permitted to provide this data in multiple other states as an approved record of the actual site performance. Also bear in mind that **one year** of wind data can easily be +/- 30%-50% off the 10 year average value.

- * The program will require all projects to calculate wind speed using the same wind speed map – NREL 2003 validated wind map

This 2003 NREL wind map is almost 10 years old, more accurate wind maps are readily available. Suggest allowing newer wind maps, or high resolution virtual MET mast reports, or actual wind data for the site.

- * Use of DSAT will be required for all REIP projects
 - * Submit a copy of DSAT report with Initial Application

Until the DSAT has been validated by an independent local group and with typical NJ site conditions, I would resist blanket adoption to the program. There are many other more mature "modeling tools" available. Once it becomes a trusted tool, no problem.

Rebate Payment Recommendation:

- 50% of the rebate paid upon project completion
- Up to the remaining 50% of the rebate paid upon demonstration of actual first year system production via an ANSI C12 meter.

The economics of small wind systems are too tight to force the customers to wait 12-14 months for significant reimbursements, and without local incentives wind power will never be competitive with other power sources. The fact that the BPU has reduced the maximum amount that they will fund and plan on pushing out the repayment schedule will derail many projects due to cash flow. The manufacturers will not wait 12-14 months for payment of their equipment. I would suggest a program like LIPA or NYSEDA, with maybe a 10%-15% final pay out after the 12 month "performance validation" period.

Rebate Structure



Current Rebate		Proposed New Rebate Structure	
Production	Rebate Amount	Production	Rebate Amount
1-16,000 kWh	\$3.20/ kWh	1-15,000 kWh	\$2.50/ kWh
16,001-1,000,000 kWh	\$0.50/ kWh	15,001-1,000,000 kWh	\$0.50/ kWh
		Project with greater than or equal to 13.4 mph or 6.0 m/s and project production is less than or equal to 500,000 kWh	Additional \$0.50/kWh
Max rebate for residential is \$51,200 & non-residential is \$543,200		Max rebate for residential is \$45,000 & non-residential is \$530,000	

Project costs continue to increase, not decrease, so the BPU should be increasing the rebate value, especially with a tighter more rigorous site/project review and approval process. Reward the good site(s) who choose the approved and proven vendors, that's how to make a successful incentive program.

Again thanks for the chance to chime in and provide input and feedback.

Regards,

Trevor R Atkinson

Applications/Sales Engineering

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Linda Wetzel

From: JFryOG@aol.com
Sent: Friday, October 28, 2011 4:10 PM
To: publiccommentswind@njcleanenergy.com
Cc: M.Winka@bpu.state.nj.us; B.Hunter@bpu.state.nj.us; jfryog@aol.com
Subject: Comments on Recommendations to revise REIP Wind Program

The following comments are being provided on the "Recommendations to Revise the REIP Wind Program":

Background – The two failures that occurred the beginning of 2011 were tragic. I applaud OCE for their actions of temporarily suspending the wind component of the Renewable Energy Program. The serious issues that arose from these failures did display some weaknesses for all the partners working the program. Protections are needed for all the partners not only the customer/owner but the manufacturer, planner and installer of a project if a turbine failure occur.

Certification/Safety/Turbine Eligibility - I completely agree that customer and product safety is paramount. The additional documentation recommended as necessary will be difficult to verify. Validating safety and durability information is only available if additional units are in operation. I believe initial safety and durability validations are tied into the engineering review conducted by a licensed NJ professional engineer. The engineers seal is there for that reason. Performance is already a basic requirement that must be validated through a third party test.

The acoustic requirement on a turbine should be addressed so as to conform to the state's nuisance noise guidelines. Each project location will have a different acoustic signature even for an identical turbine. I agree that all contracts should have the acoustic guidelines stated in the contract but the final evaluation can only be documented at the installed location. The acoustic levels are affected by the unique surroundings to a location such as trees, buildings, terrain, etc. I assume that this acoustic requirement was put in because of the correspondence BPU and/or NJDEP might have received from some residents in Ocean Gate. The sound readings recorded at NREL on the EntegriyEW-50/AOC15/50 were duplicated at the Ocean Gate site and they are in compliance with the state statutes. As of now there has been 12 complaints filed with the Ocean County Health Department of which 11 of the cases have been adjudicated and determined by the OC Health Department that no noise issue exists. The turbine meets the state's 65 dBA during daytime operation and the 50 dBA during night time operation. The one remaining complaint is being adjudicated with the OC Health Department. Accurate background readings were not taken for the one remaining complaint. In addition, the new statute passed last December by the NJ Assembly allows 55 dBA for wind energy systems at the property line. One of the overarching difficulties with taking the acoustic readings is the limitation of the measuring system which has limited wind speed capability of 12 mph or less.

The comment "other concerns at BPU staff discretion" is troubling and will lead to more confusion and possible challenges. When staff discretion is used the possibility of a subjective response rather than an objective response will always come into scrutiny. Looking from the outside it would appear that all the objective guidelines established have the possibility to be overturned with a subjective opinion.

I concur with using the SWCC guidelines. I also believe that the new 2011 NEC, Article 694, addresses small wind turbines up to 100KW. 2011 NEC should be adopted at the same time. I understand that NJDCA is not totally conversant with this code but that should not be a reason for the REIP program not to adopt it now.

NJDCA recent opinion and authorization to local inspectors leaves me with a lot of concerns. First of all the NJSWWG has tried for years to get NJDCA to the table to discuss these types of issues. I don't believe the NJSWWC ever received a positive response from them. The "field listing" is both time consuming, expensive and unnecessary. Existing codes are already in place for project certification. Both mechanical and electrical inspections are conducted before, during and at the completion of the turbine installation. In addition the foundations, towers, turbines and electrical design require a licensed New Jersey engineer to stamp. If field testing is accomplished and a failure occurs, who bears the financial responsibility for the damaged component? Who decides which components will be field tested and who will conduct the test?

The UL listings requirement will be confusing. Who will determine to what level components will require UL listing? Will every resistor or capacitor require the UL listing? If the component in the controller are foreign manufactured will they have to be UL listed or will a foreign equivalent rating be accepted? The approach provided by the NRTL is exactly what is already being done by the local inspector. The local inspector reviews the stamped plans and drawings received from the engineers. I'm not sure what else the NRTL would accomplish except to increase the project cost and delay the construction. The probability exists that a NRTL inspection of the failed units prior to their operation would not have identified any problem. I understand from the initial reviews of the failed turbines that human error may have played a part.

Insurance and Bonding – I'm not that familiar with these issues. I do know if a municipality is contracting for work there are standard insurance and bonding requirements for any government contracted work. Did anyone compare the state and municipal insurance and bonding requirements to the requirements listed in this document? I'm concerned that again these insurance and bonding requirements will only make a small wind installation more expensive and take longer to accomplish.

Warranty Information – A five year warranty is already mandated by the existing program. I believed that when the MMs conduct the final inspection they review the warranty. I believe that further delineation should be stated on what conditions or actions would be considered by the manufacturer or installer as warranty violations by the customer, thus voiding the warranty responsibility of the manufacturer and/or installer.

Program Inspection Process – I concur, there doesn't appear to be any new changes to this process.

Calculating Estimated Production for Rebate Determination – I concur with approach stated. The SWCC requirements are the best that the industry has to offer. The performance calculator has always been in contention, both positive and negative. The processes that have been used to date have been the best at that time. Moving towards DSAT and NREL wind maps will only improve the process. When will DSAT and the NREL wind maps be available to the public? Will the MMs have access to these tools or will the tools only be available to site assessors and installers? From my experience with the anemometer loan program most of the information is suspect due to the lack of consistency between the partners.

Rebate Payments and Rebate Structure – I completely and totally disagree with this new approach for rebate payment. This 50% payment and then wait a year for possibly the other

50% is ludicrous. With every new requirement that is being proposed this is just another way to completely do away with small wind in New Jersey. Remember customers have to obtain funding to have a wind turbine installed. Most of them will go to a bank for their loan. With all the paperwork and commitments required by the banks, how can the customer present a financially viable package to the bank for funding? Gee, I don't know exactly how much rebate will be approved for at least another year. According to NREL the wind at their facility was down by 50% last year and wind speeds generally vary plus/minus 20% yearly. If you happen to have a bad year the rebate will be less than planned thus causing another financial hardship to the customer. Who in their right mind would ever consider doing a small wind project? The customer is looking at a myriad of new requirements which will increase the cost of the project and also extend the time frame and then by the way wait for a year to see what their total rebate will be.

I don't completely understand why such a major change is necessary at this time for the rebate structure. Incentivizing a wind speed of greater than 6 m/s is basically meaningless. These wind speeds are located along the shorelines and the DEP has basically ruled out about 70% of that space. So why do it? If you want to provide less rebate just say so. Don't generate all these new costly and time consuming actions because they will be the greatest detriment for any small wind in NJ. Small wind will not make good fiscal sense.

Paperwork Changes – I realize that paperwork will have to change if all the new recommended requirements are enacted. I did notice if a field listing is required will that also be included in this paperwork? It appears that all these new requirements will only bog down the system and make the good intentions of renewable energy advocates think twice before proposing a new project.

Implementation of Program Changes – I have a real concern about no extensions for existing projects that are under the older rebate programs. Small wind in New Jersey was in it's infancy a few years ago. No one in the OCE or MMs had a clear picture as to what to expect. These existing projects have had to fight their way through obstacles never perceived by the program. Permitting, CAFRA, Wetlands, Historical studies, etc., etc... This has all taken a lot of time and effort by project planners, installers and customers. Now all of a sudden throw it all out and start again. I can understand the program concerns but how do you justify negating all the efforts accomplished for the program by these pioneers and forcing them to re-apply.

General Comments – I don't understand the rush to which the program is pushing these recommendations. Coming from an R&D background in machinery I understand the need to step back after a failure. The military has what they call “stand downs” when several failures occur to a similar system. These stand downs only last a few days. A review is conducted and changes are discussed and made where appropriate. The changes are only made after the failure has been investigated and corrected action is taken. In the case of small wind, yes we had a few failures. After over 6 months the failure modes have yet to be determined and already the program is being re-invented. Some of the recommendations suggested have real constructive value but the majority appear to be an over reaction to the failures. The volunteer efforts of the

NJSWWG since it's beginning has handled issues by looking at the entire situation and working hand in hand with OCE and MM's. I don't get the same fuzzy feeling this time and it appears that politics or individuals have a new agenda. Intimidation and fear of litigation appear to be the cause to dismantle the program and start over. If you review wind turbine failures from around the country you will realize that a lot are from human error. Human error can be corrected by better training and/or understanding, however, human error is not predictable.

All the added changes being recommended would not have prevented the two recent failures. I doubt seriously if there is anyone that can look at a new blade and be able to identify or recognize stress cracks. Reviewing the manufacturer's procedures would not have picked up stress cracks. The stress cracks only surface after operation. Hopefully NREL will be able to make that determination.

The only request or recommendation that I have is that we don't rush into these changes until there is conclusive evidence from the NREL analysis that confirms the need for these changes. We have waited over 6 months already, what will another 2 or 3 months impact? I am truly concerned that the new recommendations will not only make small wind unaffordable and possibly terminate it in New Jersey. I strongly urge OCE and MMs to convene another NJSWWG meeting to discuss all the comments provided prior to going to the board. Significant changes to the guidelines should not be expedited just to meet an arbitrary deadline especially since the NREL investigation has not been started. In addition the new tools that are recommended to be used have not been totally evaluated by the MMs to insure compatibility to the program.

I am available to discuss these issues and my comments. Please, let the NJSWWG discuss all the new comments prior to the Board review. The review will then be truly a result of all stakeholders not just the OCE and MMs. The complaints of a few should not drive this program.

Thank You,

James H. Fry
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New Jersey Board of Public Utilities (BPU)

Comments on the Market Managers' Proposal for 2012 Changes to the Renewable Energy Incentives Program (REIP) Wind Program, dated 10/21/2011

Submitted by:
Mike Bergey
President, Bergey Windpower Co.
President, Distributed Wind Energy Association (DWEA)

Representing DWEA

October 28, 2011

To the Honorable NJ BPU directors and staff:

Thank you for providing this opportunity to offer input on the proposed changes to the Renewable Energy Incentive Program (REIP) wind program. DWEA supports many of the changes proposed by the Market Manager, but we are also deeply concerned that some of the proposed changes will severely undercut program effectiveness and limit distributed wind's potential contribution to New Jersey's clean energy supply portfolio.

DWEA believes that the Market Manager (MM) and the OCE/BPU overreacted in suspending the REIP wind program based on two non-injury safety-related incidents and that the suspension has done harm to the sales, installation, and support infrastructure for distributed wind in New Jersey. DWEA is aware of fires, wind damage, and injuries on solar installations in other states and would be surprised if similar incidents have not occurred in New Jersey. Making it more difficult to sell high-quality, certified, wind turbines in New Jersey when the REIP restarts will compound the damage to the wind energy industry.

DWEA does recognize that the REIP needed to develop better requirements or procedures to provide customers with more accurate performance projections. But, there was no reason to stop the program while these improvements were researched, proposed, and implemented. A number of other state incentive programs have made mid-course adjustments without curtailing sales and installations.

From the latest (Oct.14) NJCEP Updated Project Status List there are 36 active wind projects and 6,443 active solar projects. We would suggest that more could be done by the OCE/BPU to incentivize and promote distributed wind projects in those parts of New Jersey with sufficient wind and suitable sites. Part of the remedy, as we see it, is to get the REIP wind program re-launched as soon as possible.

DWEA supports a number of the new provisions in the MM's proposal and in particular:

1. Certification requirements for turbine eligibility.

We are pleased to see the proposed certification requirements. While this may delay some good projects due to the time required to obtain the required certifications, we believe the long term effect will be positive for consumers and ratepayers.

2. Standardization of performance predictions.

DWEA supports the requirement of a certified power curve, the use of a prescribed performance calculator, and the use of one wind resource reference. These requirements will put all suppliers on a level playing field and provide consumers with more accurate performance and economics projections. All parties do need to understand that average wind speeds vary year to year and that variations in energy production of +/- 25% are normal and larger variations are possible.

We do have, however, some concerns about the DSAT tool, which are described in a later section.

Additionally, DWEA would recommend a requirement that manufacturers agree to stand behind the 5-year warranty in the event of dealer default. This is a requirement under the NYSERDA program and we think it's a good idea.

DWEA has the following concerns about the MM's proposal:

1. Streamlining of the "Field Listing" requirements/process required.

Although we recognize that just one NRTL provided input, we are concerned that the procedure presented by them could become the required checklist for "field listing". Even at \$3K the additional costs would be burdensome to small projects and it seems unlikely that a non-certified turbine would be able to avoid the component reviews and testing that could reportedly raise the costs to \$10-25K. As a minimum, we would suggest that a turbine that is "field listed" on one project should not have to undergo a duplicative review on subsequent projects. We would also recommend that an electrical inspection by the local building department be accepted as satisfying the assessment of the wiring of the specific project and that the "field listing" scope of work would exclude duplicative reviews of this work. In addition to the cost burden, the estimate of 2 – 6 months for the "field listing" means a significant delay in the receipt of REIP incentive payments and, if it also means that the customer cannot operate the wind system in the interim, an additional hardship on the customer. DWEA requests that the BPU work with DCA to develop a scope and procedure for "field listing" that will be less burdensome on the consumer.

2. The DSAT tool may not be the best choice.

While we fully support the need to use a common calculation tool, we do have a

concern that the DSAT tool is too new to be deemed as "reference-grade". The example presented in the MM's material was for a Bergey 10 kW on a 100m tower in a dense urban area of Wichita, Kansas. This is not a realistic scenario and it bears little resemblance to the typical distributed wind system site in New Jersey. The example then shows a 100m reference wind speed of 6.93 m/s at 100m, with a site factors correction to 5.46 m/s. There's no way to judge whether DSAT is doing a good or a bad job in determining what wind speed distribution is used in calculating turbine performance. Has the DSAT tool been vetted on existing NJ installations?

Also, we are not sure that DSAT's presumption that turbulence is the primary culprit behind poor predictions is valid. We believe that the annual average wind speeds in the wind map are a more likely suspect. If so, DSAT's requirement for terrain information in 16 directions and mapping of the 10 most significant obstacles would be little more than a fool's errand. It is also worth noting that power curves taken in accordance with IEC 61400-12 will reflect realistic turbulence deratings for low vegetation terrain, so less conservative turbulence deratings would be indicated.

DWEA recommends that the OCE/BPU undertake a thorough vetting of the DSAT model using existing NJ turbine sites before mandating its use. In the interim we recommend requiring the use of the attached free generic performance model, with the selected wind turbine's certified power curve to be added in the table on the right side. This spreadsheet method is at the heart of all performance calculators, including the Seventh Generation program and DSAT.

If DSAT is shown to provide better results we would welcome its requirement.

3. Guidance needed on use of the NREL wind map:

The NREL wind map a logical choice for an initial reference, one that was among DWEA's suggestions in our May 4th submittal. One aspect of the map, however, is that it defines a number wind speed ranges rather than a specific wind speed. OCE/BPU should, therefore, provide guidance on the appropriate average wind speed to take from the map before applying site-specific corrections for turbulence and tower height (if other than 30m). DWEA recommends using the mid-point (e.g., 4.75 m/s for the broadly distributed 4.5 – 5.0 m/s category). OCE/BPU will also have to define how an applicant shows their location on this map; perhaps with a copy of the map with the location marked.

4. The proposed "50% now / 50% after a year" payment schedule is a show-stopper for residential customers and many small businesses.

Cash flow is critical to project viability and financing is in short supply, so the proposed deferred payment schedule will have a significant dampening effect on the residential and small business wind turbine markets in New Jersey. The deferred payment approach was tried in Massachusetts with poor results at 50% and the program has now been changed to a 10% deferment. LIPA has a 10% deferment, but few sales to residential customers.

DWEA questions the logic of a deferred payment in the first place. The rebates are based on projected performance using verified power curves, a prescribed wind map, and a prescribed performance calculator. The turbines have to carry a robust warranty and suppliers must be insured. What, then, is the deferred payment protecting against? It sounds like a solution in search of a problem. DWEA recommends no deferment of part of the rebate.

5. The proposed new rebate structure is problematic.

The MM's economic analysis for the lowest tier rebate seemingly failed to consider the lower wind speeds typically available at residences and the difficulty of permitting. Residential customers need robust incentives and short payback periods to justify the time, expense, and hassle of obtaining zoning permission for the 80 – 140 ft towers required for proper siting. The REIP program needs to encourage more residential wind system installations and reducing the lowest tier rate and the cap will do just the opposite. The bonus rate for sites with 13.4 mph or higher average wind speeds will exclude almost all residential sites. DWEA recommends leaving the 1 – 16,000 kWh tier at \$3.20/kWh with a review after two years to reassess progress.

Per our May 4th submittal, DWEA believe there should be an intermediate tier for 16,001 – 250,000 kWh with a rate of \$1.25/kWh. This “mid-size tier” would fit the energy needs of farms, small businesses, and public facilities and provide proportionate incentives on the 20 – 100 kW turbines serving these markets. As with the residential segment, the REIP needs to encourage more sales of mid-size turbines and our proposed intermediate tier will, we believe, accomplish that. DWEA recommends a third tier from 250,001 – 1,000,000 kWh at the \$0.50/kWh rate.

We do not recommend providing a bonus rate for windier sites since this serves to doubly dis-incentivize customers is less than ideal wind sites. Payback period is strongly influenced by the wind resource without the bonus rate so the appropriate market signals are already in place. Only a very small percentage of New Jersey has a 6 m/s annual average, and available space, and feasible zoning restrictions. We believe the MM's bonus rebate proposal a case of, as the saying goes, “perfect being the enemy of good”. New Jersey is not ideal for solar but that has not stopped the BPU and the legislature from providing very robust incentives. For example the BPU provided a 70% rebate on solar systems for several years before the incredibly attractive SREC incentive was put in place. Aggressive rebates worked for solar and they can work for distributed wind.

6. Adding customers as additional insured is highly unusual and may not be possible on otherwise conforming policies.

General Commercial Liability Insurance carriers will add additional insured parties on policies, but there are assumed limitations on how often this might be required. It should not be a burden to have the BPU added to a policy, but it could easily become a burden and cause a problem for manufacturers if every New Jersey REIP customer must also be added. In checking with one long-term carrier for a major small turbine manufacturer we found that they would likely be

unwilling to name individual customers on policies. According to carrier this provision would also not strengthen the customer's protection in the event of a claim. We don't think this adds additional protections and we strongly recommend that this proposed requirement be dropped.

We believe that the new REIP should both provide New Jersey consumers with higher quality installations and accelerate the use of distributed wind systems in the state. We have offered suggestions that we believe will help move the program in the proper direction. Again, we appreciate the opportunity to provide input.

Respectfully submitted,

Michael Bergey
DWEA president

Generic Turbine Performance Model

Turbine Model:

Prepared For: NJ OCE
 Site Location: New Jersey
 Data Source: NREL 2003 NJ Wind Map
 Date: 10/28/2011

Inputs:

Ave. Wind (m/s) = 5.25
 Weibull K = 2
 Site Altitude (m) = 0
 Wind Shear Exp. = 0.200
 Anem. Height (m) = 30
 Tower Height (m) = 36
 Turbulence Factor = 5.0%

Results:

Hub Average Wind Speed (m/s) = 5.44
 Air Density Factor = 0%
 Average Output Power (kW) = 1.87
 Daily Energy Output (kWh) = 44.8
Annual Energy Output (kWh) = 16,343
 Monthly Energy Output = 1,362
 Percent Operating Time = 84.7%

Weibull Performance Calculations

Wind Speed Bin (m/s)	Power (kW)	Wind Probability (f)	Net kW @ V
1	0.00	5.20%	0.000
2	0.00	9.60%	0.000
3	0.10	12.60%	0.012
4	0.38	13.94%	0.053
5	0.81	13.70%	0.110
6	1.43	12.25%	0.176
7	2.28	10.10%	0.230
8	3.42	7.73%	0.265
9	4.82	5.52%	0.266
10	6.51	3.69%	0.241
11	8.42	2.32%	0.195
12	10.34	1.37%	0.141
13	11.49	0.76%	0.087
14	11.78	0.40%	0.047
15	11.87	0.20%	0.023
16	11.92	0.09%	0.011
17	11.88	0.04%	0.005
18	11.82	0.02%	0.002
19	11.60	0.01%	0.001
20	11.39	0.00%	0.000
2011	Totals:	99.55%	1.866

Weibull Calculations:

Wind speed probability is calculated as a Weibull curve defined by the average wind speed and a shape factor, K. To facilitate piece-wise integration, the wind speed range is broken down into "bins" of 1 m/s in width (Column 1). For each wind speed bin, instantaneous wind turbine power (W, Column 2) is multiplied by the Weibull wind speed probability (f, Column 3). This cross product (Net W, Column 4) is the contribution to average turbine power output contributed by wind speeds in that bin. The sum of these contributions is the average power output of the turbine on a continuous, 24 hour, basis. Best results are achieved using annual or monthly average wind speeds. Use of daily or hourly average speeds is not recommended.

Instructions:

Inputs: Use annual or monthly **Average Wind** speeds. If **Weibull K** is not known, use K = 2 for inland sites, use 3 for coastal sites, and use 4 for island sites and trade wind regimes. **Site Altitude** is meters above sea level. **Wind Shear Exponent** is best assumed as 0.18. For rough terrain or high turbulence use 0.22. For very smooth terrain or open water use 0.11. **Anemometer Height** is for the data used for the **Average Wind** speed. If unknown, use 10 meters. **Tower Height** is the nominal height of the tower, eg.: 24 meters. **Turbulence Factor** is a derating for turbulence, site variability, and other performance influencing factors -- typical turbulence has already been incorporated into the model. Use 0.00 (0%) for level sites with limited obstructions. Use -0.10 (negative 10%) for flat, clear sites on open water. Use 0.05 to 0.15 (5% to 15%) for rolling hills or mountainous terrain.

Results: **Hub Average Wind Speed** is corrected for wind shear and used to calculate the Weibull wind speed probability. **Air Density Factor** is the reduction from sea level performance. **Average Power Output** is the average continuous equivalent output of the turbine. **Daily Energy Output** is the average energy produced per day. **Annual and Monthly Energy Outputs** are calculated using the Daily value. **Percent Operating Time** is the time the turbine should be producing some power.

Limitations: This model uses a mathematical idealization of the wind speed probability. The validity of this assumption is reduced as the time period under consideration (ie, the wind speed averaging period) is reduced. This model is best used with annual or monthly average wind speeds. Use of this model with daily or hourly average wind speed data is not recommended because the wind will not follow a Weibull distribution over short periods. *Your performance may vary.*