Note to Applicant: The information that identifies the applicant is for program records and will not be distributed to the judging committee prior to selection of awards. Judging is a blind selection process. ***Applicants must not mention the school, town or district name other than where that information is requested, or they will be disqualified.*** Be sure to keep a copy of the entire application and program information for your records.

2010-2011 PSEG Environmental Education Grant Application

Title of Project: Windmill Generators: A Possibility for a "Greener" Tomorrow.

Dates project will begin and conclude: Begins 2010-2011 school year with small group, expands 2011-2012 in large group

Grade Level(s): Earth Systems Honors (9)

Number of students involved: 90 in year one, with expansion in year two.

Project Narrative (Not to exceed 3 pages total)

1. **Project Objectives:** What are the students trying to discover? (What will this program accomplish? What are the intended outcomes?)

2. **Project Description and Activities:** Briefly describe the project and expected duration of the project. Especially describe inquiry-centered (hands-on) tasks, field trips and other project components that include direct student involvement. Describe how this program links environmental education concepts with an understanding of science, mathematics, computer science and/or technology. Clearly identify the meaning of acronyms and abbreviations.

3. **Student Participation:** What results from your project will enable students in your class(es) to learn about and appreciate the environment? Is there a role or an impact for other students in your school/district?

4. **Community Participation:** What results from your project will enable the community to learn about and appreciate the environment? Is there a role or an impact for the community at large in your school/district?

5. **Evaluation:** How do you plan to evaluate the success of your project? (Please refer to your original objectives and intended outcomes.) Will you use a pre- and post-assessment to try to measure what concepts or skills or problem-solving techniques were learned? What tasks or knowledge will you expect students to be able to do/know after having completed the project? How will you measure this? In your evaluation plan, be sure to specifically explain which New Jersey Core Curriculum Content Standards (for New Jersey schools) or Delaware Content Standards (for Delaware schools) you will meet and how; please include the number of the Standard (e.g., 3.22) as well as a description.

Materials and Budget (Not to exceed one page)

List the specific materials, equipment, supplies and field trips needed to implement the project and their appropriate cost, to the nearest dollar. ***Budget maximum is $3,500.***

Item Description	Quantity	Total Cost	Brief Description of Item Use
Field Trips (not to exceed $700):			
Equipment (not to exceed $2,100):			***SEE ATTACHED***
Expendable Supplies:			
Total Budget Cost: $			

Applications must be postmarked by Wednesday, June 30, 2010. Grantees will be announced in October. Send completed applications to:

PSEG Environmental Education Grant Program
c/o PSEG Community Affairs Department
80 Park Plaza, T-10C
Newark, NJ 07102

If you have a question about the grant program, send e-mail to shauwea.hamilton@pseg.com.

Project Objective:

Energy is one of the most essential needs for all human beings. As per the law of conservation of energy, energy can neither be created nor can it be destroyed; it can only be converted from one form into another. Energy is stored by nature in diverse sources and in various forms. The sources of energy available from nature are divided into two main types: renewable energy sources and non-renewable energy sources. The energy which replenishes itself quickly and available in a never ending supply is known as renewable energy. This type of energy comes from natural resources like sun, wind, water, heat from the earth, and biomass. There is no limit to the renewable sources of energy on our planet. The energy sources that cannot be re-created and which continue depleting as we consume them are referred to as non-renewable energy sources. At present most of the needs of the world are fulfilled by non-renewable sources of energy. The most broadly used non-renewable energy sources are fossil fuels such as oil, natural gas and coal.

Students at The High School will investigate, explore, and compare sustainable renewable energies as increasingly desirable alternatives for the twenty first century. One specific renewable energy source is wind energy. Students know that wind cools us on a summer day, moves our sailboats, flies our kites and helps plants grow. What they gain to learn is that wind energy is a clean form of energy we are starting to utilize. The conversion of wind energy to various other useful forms, like electricity, is known as wind power. Wind energy is converted into these forms using wind turbines. Electricity generated by wind turbines won't contaminate the air we breathe or emit pollutants like other energy sources. The benefits to learning, exploring, and embracing alternate energy sources could mean less smog, less acid rain, and fewer greenhouse gas emissions. At the conclusion of the unit, our Earth Systems Students will use their newly acquired knowledge to construct their very own windmill generators that measure current output. In addition, they will take measurements and analyze their data by graphing in Excel to relate power to the rate of rotation of a windmill's rotor. Finally, students will take the lessons learned from their scale models and connect them to how a real wind farm operates by visiting a working plant in New Jersey.

Project Description and Activities:

Project Description:

Channeling the power of wind promises to be one the new "clean" energy sources of the future. In this project, students will build a model of a wind-driven power generator and measure its output. They will obtain data using a laser tachometer and a multimeter. By doing this activity, students will gain first-and experience in how the energy of the wind is converted into the energy that arrives at your home as electricity.

Activities to occur throughout the unit:

- Earth Systems Integration Unit (30-36 days)
    - Students will be able to answer the following Essential Questions following classroom lecture, lab experiments, and activities.
        - What are characteristics of sustainable resources?
        - How have human activities changed Earth's spheres?
        - How is environmental risk assessed?
- Individual research project (2 weeks)
    - Students will select one of the learned natural energies and research that energy in greater detail. Students will present their findings through oral presentations, videos, posters, or in another medium of their choice.
- Windmill Generator construction (1 week)
    - Students will build their own windmill generators in pairs in order to collect data.
- Formal written lab report (1 week)
    - Students will make conclusions and present all data collected.
- Field trip to Jersey-Atlantic Wind Farm (1 day)
    - Student will see first hand what a wind farm looks like and how it operates. Students will be required to answer follow up questions about their experience and tour.
        - How does a windmill generator create an electrical current?
        - How does the United States compare, in megawatts, to other countries in its production of wind power?
        - What is the power output of a modern full-sized windmill generator?
        - How much does it cost to build/construct a windmill generator?

- Why was Atlantic City chosen for a wind farm?
- How fast of a wind do windmill generators need in order to convert wind into electricity?
- What are the advantages/disadvantages to off-shore turbines?
- Would "our town" be an ideal spot to have a wind farm? How would the residents feel?

Student Participation:

Students who will be participating in this project will be 9th grade Earth Systems students who will be registered in the 2010-2011 Honors program. In addition to the experiences they will be engaged in during their class periods, enrolled students will be able to expose additional classmates to the information through presentations and visitations. During these visits, students will be able to take recent current events, such as the Gulf oil spill, and explain the impact on the environment, people and planet Earth. They can debate and compare current resource extraction methods to alternative "green" techniques-thus sparking education, curiosity, and power. This program will then continue with a larger group of students for the 2011-2012 school year.

Community Participation:

Students will present their studies and findings to the "our town" Township Board of Education and community at a public meeting during the 2010-2011 school year. Community members would also be invited to chaperone the field trip.

Evaluation:

Students will be evaluated during the course of the entire unit of Earth Systems Integration. For the project component of the unit, students will be evaluated based on their completion of the following tasks:

- Did they follow the project directions? Does the generator work properly?
- Did they record their measurements using Excel?
- Did they properly graph their results using Excel?
- Did they complete at least 3 out of the 4 project variations?
- Did they submit a proper lab report concluding their findings and results of the project?
- Reflection of project/experience. What did they learn that they did not know before this unit, what part was the most exciting, the most cumbersome, how have their environmental views changed, and what changes would they make to enhance the success of the project for next year?
- Pre-assessment and post-assessment comparisons.

A major component of evaluating project success will be the pre- and post-assessments. Students should demonstrate an increased appreciation for the environment as well as mastery of content. In addition, the public presentation to the Board of Education and community should demonstrate their greater understanding of how alternative energies can help sustain our planet. Many people are not aware of the impact renewable energy, particularly wind energy, can have on the earth and this project will help our students become more informed and educate their community as well.

This unit addresses the following New Jersey's Core Content Standards in science:

- Standard 5.1 Science Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science
    - Strand A. Understand Scientific Explanations: Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world.
        - 5.1.12.A.3: Revisions of predictions and explanations are based on systematic observations, accurate measurements, and structured data/evidence. Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence.
    - Strand B. Generate Scientific Evidence Through Active Investigations: Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.

        - 5.1.12.B.1: Logically designed investigations are needed in order to generate the evidence required to build and Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data. refine models and explanations.
        - 5.1.12.B.2: Mathematical tools and technology are used to gather, analyze, and communicate results. Build, refine, and represent evidence-based models using mathematical, physical, and computational tools.
        - 5.1.12.B.3: Empirical evidence is used to construct and defend arguments. Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories.
        - 5.1.12.B.4: Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.
    - Strand C. Reflect on Scientific Knowledge: Scientific knowledge builds on itself over time.
        - 5.1.12.C.1: Refinement of understandings, explanations, and models occurs as new evidence is incorporated. Reflect on and revise understandings as new evidence emerges.
        - 5.1.12.C.2: Data and refined models are used to revise predictions and explanations. Use data representations and new models to revise predictions and explanations.
        - 5.1.12.C.3: Science is a practice in which an established body of knowledge is continually revised, refined, and extended as new evidence emerges. Consider alternative theories to interpret and evaluate evidence-based arguments.
    - Strand D. Participate Productively in Science: The growth of scientific knowledge involves critique and communication, which are social practices that are governed by a core set of values and norms.
        - 5.1.12.D.1: Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.
        - 5.1.12.D.2: Science involves using language, both oral and written, as a tool for making thinking public. Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams.
        - 5.1.12.D.3: Ensure that instruments and specimens are properly cared for and that animals, when used, are treated humanely, responsibly, and ethically. Students will be able to demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare.
- Standard 5.4 Earth Systems Science: All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems and is a part of the all-encompassing system of the universe.
    - Strand G. Biogeochemical Cycles: The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity
        - 5.4.12.G.2: Natural ecosystems provide an array of basic functions that affect humans. These functions include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Here students will be able to explain the unintended consequences of harvesting natural resources from an ecosystem.
        - 5.4.12.G.5: Human activities have changed Earth's land, oceans, and atmosphere, as well as its populations of plant and animal species.
            - Assess and compare (using maps, local planning documents, and historical records) how the natural environment has changed since humans have inhabited the region.
        - 5.4.12.G.6: Scientific, economic, and other data can assist in assessing environmental risks and benefits associated with societal activity.
            - Assess and predict(using scientific, economic, and other data) the potential environmental impact of large-scale adoption of emerging technologies (e.g., wind farming, harnessing geothermal energy).

Materials and Budget:

Item Description	Quantity	Total Cost	Description of Use
Jersey-Atlantic Wind Farm Field Trip	1	$0	Students tour NJ only working wind farm facility in Atlantic City, NJ
Jersey-Atlantic Wind Farm Field Trip Transportation	2 busses including parking	$1629.50	Transportation to Wind Farm
Green Science Windmill Generator-3649 (www.grtoys.com)	11 at $12.99 each with free shipping	$142.89	Learn about renewable energy with this wind generator. LED light will glob as it is powered by free energy from wind.
Neiko Professional Digital Laser Photo Non-Contact Tachometer (www.amazon.com)	15 at $27.99 each with free shipping	$419.95	Highly accurate digital laser photo tachometer. To take the measurement, apply a reflective mark onto the target object, aim the laser, and the RPM displays on large LCD screen.
Palm-size Digital Multimeter, DT830B (www.amazon.com)	15 at $6.99 each with free shipping	$104.85	Digital AC/DC multimeter with diode and transistor test function.
1/8 Watt 1K Carbon Film Resistors – 5 pack (www.radioshack.com)	9 at 0.99 each with free shipping	$8.91	Convenient 5 pack of resistors with 5% tolerance
24" Insulated Test/Jumper Leads (www.radioshack.com)	4 at $7.99 each + $6.06 shipping	$38.02	A set of 8 color coded mini alligator test leads provide secure connections for easier testing.
La Crosse Technology EA-3010U Handheld Anemometer (www.amazon.com)	15 at $33.28 each with free shipping	$499.20	Comes in weather resistant casing making it ideal for use during rainy weather. After 5 seconds of powering up, the anemometer reports the current wind speed in a variety of units
Lasko 20-Inch Premium Box Fan 3-Speed (www.amazon.com)	6 at $24.99 each with free shipping	$149.95	Additional source of wind.

Total Cost: $2993.27

- Field Trip: $1629.50
- Equipment: $1363.77
- Expendable Supplies: $0