NEW YORK STATE
VIRTUAL WIND FARM
STUDENT GUIDELINES

Noble Bliss Wind Park
Wyoming County, NY

PARTICIPATION LEVEL III: GRADES 9-12

New West Technologies, LLC

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OVERVIEW

Wind power is currently the fastest-growing renewable energy source in the world. In 2008, the wind power industry grew by 35% in the U.S. alone, and New York State is among the most rapidly expanding locations in the nation.

> NYSERDA's **School Power… Naturally**[SM] **(SPN)** is a New York Energy $mart[SM] Schools Program designed to educate citizens about the role that renewable energy can play in providing clean energy to our schools, homes, and businesses. In 2004, the program installed 2kW Photovoltaic systems on 50 schools and developed curriculum for students to use these systems as a learning tool. NYSERDA is now enhancing the existing resources and expanding to cover other renewable energy sources, such as wind power. For more information, visit the **School Power… Naturally**[SM] website at: **www.schoolpowernaturally.org**

Operational Wind Farms in New York State

County	Wind Farm (Capacity in MW)
Allegany	Noble Allegany (101)
Chautauqua	Noble Ball Hill (95)
Clinton	Noble Altona (98), Noble Clinton (101), Noble Ellenburg (81)
Erie	Steel Winds (20)
Franklin	Noble Bellmont (21), Noble Chateaugay (107)
Lewis	Maple Ridge (320)
Madison	Fenner (30), Madison (12), Munnsville (35)
Steuben	Dutch Hill (125)
Wyoming	Noble Bliss (101), Noble Wethersfield (126)

According to the New York State Energy Research and Development Authority (NYSERDA), New York is potentially capable of producing approximately 20% of the state's electricity consumption using the abundant wind sources moving across Lake Ontario, Lake Erie, and the Atlantic Ocean. NYSERDA also estimates that, less than one percent of New York's energy currently comes from wind.[1] The largest barrier to expanding wind power generation is the lack of awareness concerning the available wind potential, as well as common misconceptions about the drawbacks of wind turbine systems. In order to further education and awareness concerning wind power, New West Technologies, LLC has developed a virtual wind farm competition for middle school and high school students as part of NYSERDA's *School Power…Naturally*[SM] Program.

PURPOSE

This is a resource to create the most efficient virtual wind farm design using the Virtual Wind Farm Tool, a graphical web-based computer application that replicates the considerations used to plan a wind farm. These activities provide an introduction to wind turbine technology and the wind farm design process.

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[1] "Frequently Asked Questions." NYSERDA. 2004. www.nyserda.org/rps/faq.asp Accessed 02 July, 2009

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VIRTUAL WIND FARM ACTIVITY PROCEDURE

I.   *Wind Turbine Concepts*

Start by conducting preliminary research to become more familiar with such concepts as available wind resources in New York State, the main components of a wind turbine, key land features that affect the placement of a wind turbine, and space requirements for developing a wind farm. Your instructor will provide further details regarding the method to use for learning this information.


> The design with the <u>lowest</u> value for the **Cost to Energy Ratio** that meets all *Wind Farm Specifications* will be deemed the best design.

II. *The Virtual Wind Farm*

Review the *Wind Farm Specifications* and use the Virtual Wind Farm Tool to design your wind farm as follows:

1. Use the following URL link or enter the URL address in the navigation bar on the Internet browser to open the Virtual Wind Farm Tool:

   www.powernaturally.org/Programs/SchoolPowerNaturally/VirtualWindFarm/login.aspx

2. Use the *Anemometer*   *tool* to measure wind speed in order to locate sufficient wind resources.
3. Place *turbines*   at the selected site and specify turbine type, blade diameter, and tower height.
4. Consider physical, environmental, and human factors that might influence the installation location.
5. Adjust the location and variables as necessary in order to achieve a minimum **COST TO ENERGY RATIO**.
6. Label the nearest roadway that will be used to access this site for installation.
7. Use the **Validate** tool to confirm that your design meets the wind farm specifications.
8. **Save** your work often and use the **Print Summary** tool to view your final wind farm design.
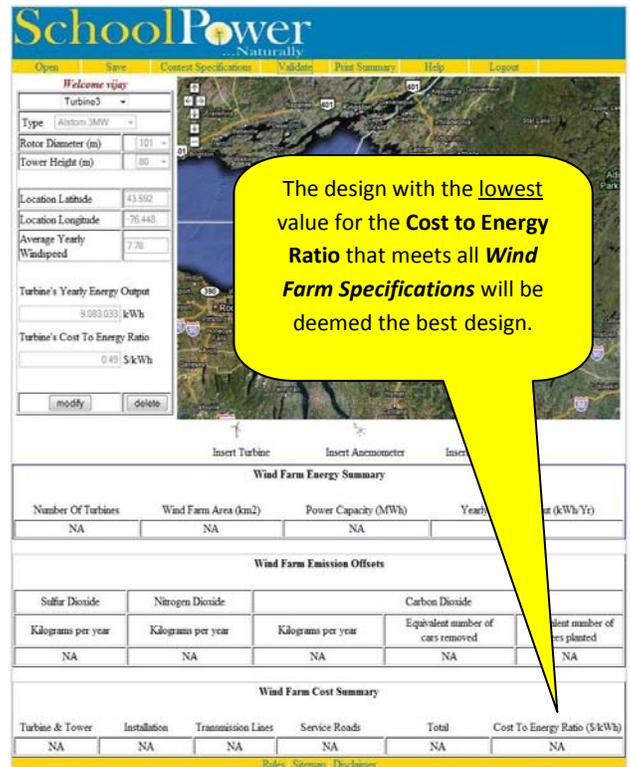
Wind Farm Specifications

- All designs must be created using the Virtual Wind Farm Tool.
- The total power capacity must be equal to 24MW.
- The wind farm area must not exceed 8 square kilometers.
- The minimum spacing between turbines is 200 meters (m) per MW.
  (Example: an 800kW turbine must be 160m from the nearest turbine; while a 3MW turbine must be 600m from the nearest turbine)
- All work must be completed only by the participating student/group.
- The wind farm location may be restricted to a particular county in NYS.

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DEVELOPMENT OF SUPPORTING DOCUMENTATION

III. *Development of the Design Synopsis*

Develop a brief summary that provides an informative explanation of the logic behind all design decisions along with a detailed description of the proposed wind farm layout. You may wish to include a more detailed map of the proposed layout beyond what is produced by the Virtual Wind Farm Tool to identify wildlife management areas, public parks, waterways, residential and public developments, or other things that may have influenced the design or location of your wind farm. You are encouraged to use any additional visuals, such as graphs and diagrams, which may further support your reasoning. The design synopsis **should not exceed four pages** and should address:

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1. What physical, environmental, and human factors led you to select the location you used?

2.   What factors led you to select the turbine type, blade diameter, and tower height you used?

3. What makes your design more efficient than other options?

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IV.   *Development of an Outreach Component*

Complete an outreach assignment that aims to inform the community about the benefits of utilizing wind energy. This could be a poster, website, speech or presentation, letter to elected officials, or a format of your choosing (be creative). The objective should be to accurately and effectively convey information in a compelling way in order to raise both interest and awareness concerning wind power generation.

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EVALUATION

The virtual wind farm components can be scored out of a possible 100 points, which is calculated by adding the points from the Wind Farm Design (50 possible points), Design Synopsis (25 possible points), and Outreach Component (25 possible points).

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│ *Virtual Wind Farm Components*   │
│   │
│ 1) Virtual Wind Farm   │
│   │
│ 2) Synopsis of Design Decisions   │
│   │
│ 3) Outreach Component   │
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I. *Wind Farm Design* (50 points)

The best design will earn a total of 50 points and all others will be awarded a fraction of the points based on their comparison with the winning design. Designs will be evaluated based on the lowest **COST TO ENERGY RATIO**, provided that all *Wind Farm Specifications* have been met.

II. *Design Synopsis* (25 points)

The provided **Design Synopsis Evaluation Rubric** outlines the evaluation criteria and corresponding point system that will be used to score the design synopsis.

III. *Outreach Component* (25 points)

The provided **Outreach Component Evaluation Rubric** outlines the evaluation criteria and corresponding point system that will be used to score the outreach component of this project.

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Design Synopsis Evaluation Rubric (25 points total)

	0	**1**	**2**	**3**	**4**	**5**
Communication of Results	Does not demonstrate effective use of visuals and communication tools.	Demonstrates minimal use of visuals and effective communication tools.	Demonstrates some use of visuals and effective communication tools.	Demonstrates fairly effective use of visuals and communication tools.	Demonstrates effective use of visuals and communication tools.	Demonstrates exceptional use of visuals and communication tools.
Creativity and Originality	Does not convey the logic behind location and design decisions with creativity or originality.	Conveys the logic behind location and design decisions with minimal creativity and originality.	Conveys the logic behind location and design decisions with little creativity and originality.	Conveys the logic behind location and design decisions with some creativity and originality.	Conveys the logic behind location and design decisions with creativity and originality.	Conveys the logic behind location and design decisions with exceptional creativity and originality.
Consideration for Physical, Environmental, and Human Factors	There is no consideration for physical, environmental, and human factors.	Demonstrates minimal consideration for physical, environmental, and human factors.	Demonstrates little consideration for physical, environmental, and human factors.	Demonstrates some consideration for physical, environmental, and human factors.	Demonstrates consideration for physical, environmental, and human factors.	Demonstrates exceptional consideration for physical, environmental, and human factors.
Demonstrated Comprehension	Does not demonstrate comprehension of key concepts.	Demonstrates minimal comprehension of key concepts.	Demonstrates little comprehension of key concepts.	Demonstrates some comprehension of key concepts.	Demonstrates comprehension of key concepts.	Demonstrates sound comprehension of key concepts.
Format, Spelling, and Grammar	Does not demonstrate a coherent format and/or consists of several spelling and/or grammatical errors.	Demonstrates only a somewhat coherent format and/or has more than a few spelling and/or grammatical errors.	Demonstrates a coherent format and consists of few spelling and/or grammatical errors.	Demonstrates a coherent format and is free of spelling and/or grammatical errors.	Demonstrates a highly logical format and consists of few spelling and/or grammatical errors.	Demonstrates a highly logical format and is free of any spelling and/or grammatical errors.

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<u>Outreach Component Evaluation Rubric</u> (25 points total)

	0	**1**	**2**	**3**	**4**	**5**
Communication of Results	Does not demonstrate effective use of visuals and communication tools.	Demonstrates minimal use of visuals and effective communication tools.	Demonstrates some use of visuals and effective communication tools.	Demonstrates fairly effective use of visuals and communication tools.	Demonstrates effective use of visuals and communication tools.	Demonstrates exceptional use of visuals and communication tools.
Ingenuity	Demonstrates a lack of imagination and resourcefulness.	Demonstrates minimal imagination and resourcefulness.	Demonstrates little imagination and resourcefulness.	Demonstrates adequate imagination and resourcefulness.	Demonstrates imagination and resourcefulness.	Demonstrates a great deal of imagination and resourcefulness.
Outreach	Demonstrates no effort to raise awareness about the benefits of wind power in the community.	Demonstrates minimal effort to raise awareness about the benefits of wind power in the community.	Demonstrates little effort to raise awareness about the benefits of wind power in the community.	Demonstrates some effort to raise awareness about the benefits of wind power in the community.	Demonstrates an effort to raise awareness about the benefits of wind power in the community.	Demonstrates an exceptional effort to raise awareness about the benefits of wind power in the community.
Accuracy of Information	Presents information that is either inaccurate or completely irrelevant.	Presents somewhat relevant information with minimal inaccuracies.	Presents fairly relevant information with minimal inaccuracies.	Presents accurate information that is fairly relevant.	Presents information that is both relevant and accurate.	Presents a wealth of information that is both relevant and accurate.
Spelling, Grammar, and Format	Does not demonstrate a coherent format and/or consists of several spelling and/or grammatical errors.	Demonstrates a minimally coherent format and/or has more than a few spelling and/or grammatical errors.	Demonstrates a fairly coherent format and consists of few spelling and/or grammatical errors.	Demonstrates a fairly coherent format and is free of spelling and/or grammatical errors.	Demonstrates a highly logical format and consists of few spelling and/or grammatical errors.	Demonstrates a highly logical format and is free of any spelling and/or grammatical errors.