Wind Machine: 5E Activity

Christopher English, Wooster High School
Grade Level – High School

Purpose: To explore wind as a possible source of electricity

Materials: Corks, Motors, Electrical Connecting Wire, Rulers, Rubber Bands, Paper clips, Tape, alligator clips (optional), wire cutters or pliers, cardboard, glue, pin, voltmeter, ammeter, fan or hair dryer, scissors.

Precautions: Keep fingers and materials a safe distance away from fan, careful with sharp objects and other materials. Utilize eye protection.

Standards addressed:

- P.5.C.5 Students know the organization of a simple electrical circuit (i.e., battery or generator, wire, a complete loop through which the electrical current can pass).
- P.8.C.6 Students know electrical circuits provide a means of transferring electrical energy to produce heat, light, sound, and chemical changes.
- P.12.C.6 Students know electricity is transferred from generating sources for consumption and practical uses.

5E Activity

Engagement: Explore video clips of a wind turbine: "Science 360 Green Revolution: Wind"; Discovery: "Building the future: Oceanic Wind Turbines"; Planet Green: "Renovation Nation Wind Turbines." Virtually explore existing windfarms and windmill designs.

Exploration:

Procedure:

1. Get a small motor and a ruler or piece of wood from teacher.
2. Attach motor to ruler with rubber band.
3. Cut two 30 cm (ruler length) pieces of electrical wire.
4. Strip ends of wire, and attach one end of each wire to the motor's outlets. Attach other end to alligator clips if available.
5. Cut out six pieces of cardboard, these will be the blades of your wind turbine.
6. Cut out more than one set of blades (longer and shorter) for comparison.
7. Glue six paper clips to cardboard blades.
8. Insert paper clips into cork (making a hole with a pin first may help)
9. Attach motor to cork by inserting the protruding metal piece of motor into cork.

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10. Turn on fan, and attach alligator clips to voltmeter, record voltage.
11. Attach alligator clips to ammeter, record amps produced.
12. Experiment with design, try to maximize volt and amp output.
13. Using the equation Watts = Volts x Amps, calculate the power produced by your most efficient design.

Explanation:

Questions:

1. What are Volts? What are Amps? What are watts?
2. What is voltage? What is current? What is power?
3. What is electricity? What is an electric current?
4. Do blades with longer or shorter length produce more electricity?
5. What are some of the things you have to take into consideration when deciding what length to make your blades? The material of your blades?
6. If you were going to plan a wind farm, what are some of the things you would need to take into consideration?

Extension:

1. Determine the amount of electricity produced by a coal-fired power plant.
2. In an area with an average wind speed of 20mph, calculate how many windmills would be needed to produce the same amount of electricity as the coal-fired power plant. Choose a windmill design already in use/existence.
3. Imagine you are an owner of a private windmill company. Write a persuasive letter to a legislator or city planner presenting a strong argument for why they should use available land for a wind farm, instead of a coal-fired power plant.

Evaluation:

1. Discuss and compare results.
2. Discuss why results might vary from group to group.
3. How does this topic relate to science, technology, engineering, and mathematics?
4. What are some of the pros and cons of using wind turbines as a source of electricity?
5. Write a paragraph describing how Wind turbines are able to convert the motion of the air into electricity.

Appendix: Illustrations and Information:

1. Diagram of components of wind turbine.
2. Bernoulli's principle of wind speed and pressure differentials.
3. Fan blade physics, curves and twists regulating fan speed.

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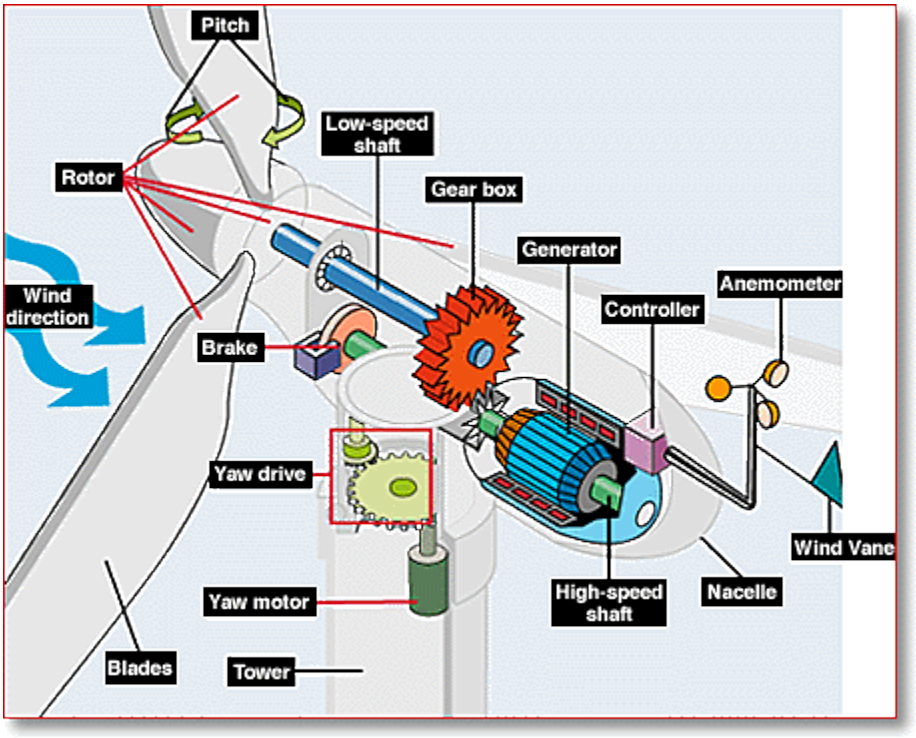
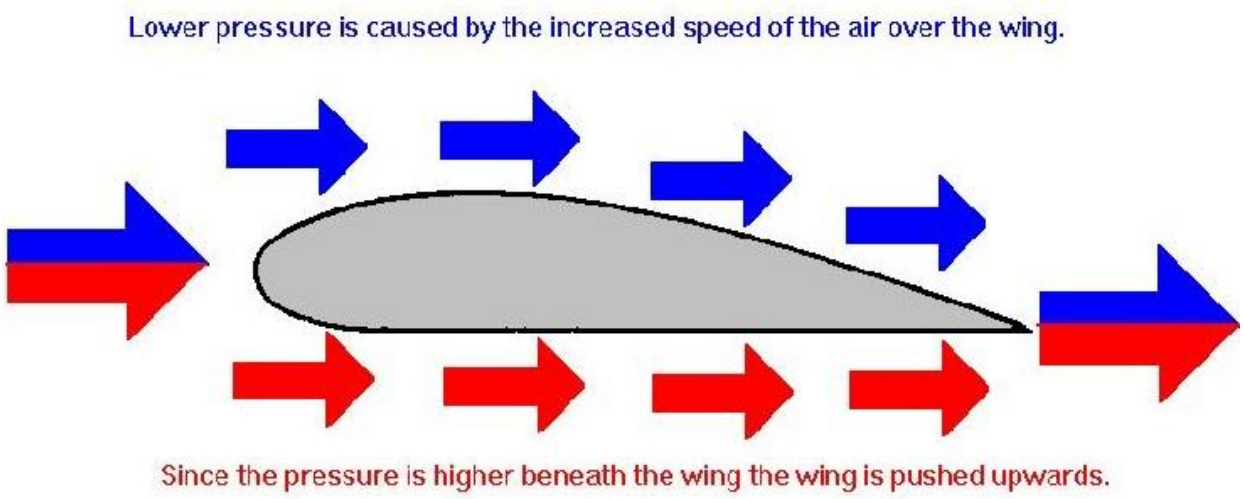


1. Diagram of components of wind turbine



2. Bernoulli's principle of wind speed and pressure differentials

3. Fan blade physics, curves and twists regulating fan speed:
http://answers.yahoo.com/question/index?qid=20070311073857AAeOadF

Inquiries and comments regarding this lesson can be directed to Chris English, Wooster High School, 1331 E Plumb Lane, Reno, NV 89502, 775-331-5100, or by e-mail: Christopher English <CEnglish@washoeschools.net>

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