



Get Blown Over by the Wind

Program Purpose

Through interactive activities introduce energy concepts and their relation to students' everyday lives.

Length of Program: 1 ½ - 2hrs

Age: Grades 6-8

Maximum Number of Participants: 24

Objectives:

After completion of all activities, students will be able to:

- Define Energy
- Understand that the sun also gives us wind energy
- Able to list at least three renewable energy sources
- Understand how wind energy works
- Build a Wind turbine and test its ability to function
- Build an anemometer and understand its function

Preparation:

Before the class arrives:

- Locate the program box in the work room
- Decide which activities to use based on age appropriateness

Materials:

50 3 ounce paper Dixie cups
36 straight plastic soda straws
6 straight pins
6 scissors
3 hole punches
3 staplers
12 pencils w/ erasers
100 index cards
String
Tape
4 Box fans
Stop watch
1" x 8" strips of paper

Outline:

- I. Introduction
- II. Wind Energy
- III. Build your own anemometer
- IV. Wind Turbines
- V. Conclusion

Introduction:

Introduce yourself to the class and explain that we will be talking about energy. What is energy, and where does it come from?

Energy is defined as the ability to do work. Energy can be chemical, like that stored in food, light, sound, electrical and mechanical. We are going to focus on electricity. Where does electric energy come from? Not all energy is created the same way. Energy can come from wind, water, sun, natural gas, and coal. Some energy is always there for our use, like the sun. More energy is produced from the sun in one day than humans have ever used! Other examples of continuous energy sources are water and wind. But sometimes, the energy we use comes from deep within the Earth, from plants and animals that died millions of years ago...fossil fuels are often hard to get to and produces pollution as they are burned as fuel. Pollution makes it hard for animals to breathe and for plants to grow. That's why we are trying to use more renewable energy sources, like wind power.

Wind power is actually dependent upon the sun. Wind energy is a converted form of solar energy. The sun's radiation heats different parts of the earth at different rates-most notably during the day and night, but also when different surfaces (for example, water and land) absorb or reflect at different rates. This in turn causes portions of the atmosphere to warm differently. Hot air rises, reducing the atmospheric pressure at the earth's surface, and cooler air is drawn in to replace it. The result is wind. Air has mass, and when it is in motion, it contains the energy of that motion ("kinetic energy"). Some portion of that energy can be converted into other forms, mechanical force or electricity that we can use to perform work.

That work is generating energy for your home. The primary style of wind turbine is called a horizontal axis or propeller style. Horizontal axis constitutes nearly all of the utility turbines in the world. Like old fashioned windmills, today's wind turbines use blades to collect the wind's kinetic energy. The wind flows over the blades creating lift, like the effect on airplane wings, which causes them to turn. The blades are connected to a drive shaft that turns an electric generator to produce electricity.

In 2008, about 1.3% of total U.S. electricity generation came from wind turbines. Although this is a small

fraction of the Nation's total electricity production, it was enough electricity to serve 4.6 million households or to power the entire State of Colorado. The amount of electricity generated from wind has been growing rapidly in recent years. Generation from wind in the United States nearly doubled between 2006 and 2008. The government is planning to have 20% of U.S. energy come from wind by 2030. In the 1970s, oil shortages pushed the development of alternative energy sources. In the 1990s, the push came from a renewed concern for the environment in response to scientific studies indicating potential changes to the global climate if the use of fossil fuels continues to increase. Wind energy is an economical power resource in many areas of the country. Wind is a clean fuel; wind power plants (also called wind farms) produce no air or water pollution because no fuel is burned to generate electricity. Growing concern about emissions from fossil fuel generation, increased government support, and higher costs for fossil fuels (especially natural gas and coal) have helped wind power capacity in the United States grow substantially over the past 10 years.

Build your own Anemometer & Wind Turbine

Operating a wind power plant is not as simple as just building a windmill in a windy place. One important thing to consider is how fast and how much the wind blows at a given location. As a rule, wind speed increases with altitude and over open areas that have no windbreaks. Good sites for wind plants are the tops of smooth, rounded hills, open plains or shorelines, and mountain gaps that produce wind funneling. Wind speed varies throughout the United States. It also varies from season to season. In Tehachapi, California, the wind blows more from April through October than it does in the winter. This is because of the extreme heating of the Mojave Desert during the summer months. The hot air over the desert rises, and the cooler, denser air above the Pacific Ocean rushes through the Tehachapi mountain pass to take its place. In a state like Montana, on the other hand, the wind blows more during the winter.

Before we build our wind turbine we need to know where the best locations would be. To do that we must be able to measure the wind speeds using an anemometer. Divide the class into groups of no more than four students. Take four of the Dixie cups and punch a hole in each about half an inch below the rim. Take the fifth cup and punch four equally spaced holes about a quarter inch below the rim. Then punch a hole in the center of the bottom of the cup. Take one of the four cups and push a soda straw through the hole. Fold the end of the straw, and staple it to the side of the cup across from the hole. Repeat this procedure for another one-hole cup and the second straw. Now slide one cup and straw assembly through two opposite holes in the cup with four holes. Push another one-hole cup onto the

end of the straw just pushed through the four-hole cup. Bend the straw and staple it to the one-hole cup. Repeat this procedure using the other cup and straw assembly and the remaining one-hole cup. Align the four cups so that their open ends face in the same direction around the center cup. Push the straight pin through the two straws where they intersect. Push the eraser end of the pencil through the bottom hole in the center cup. Push the pin into the end of the eraser as far as it will go. Your anemometer is ready to use. By counting the rotations per minute you can determine if the location is better or worse than others. Try using your anemometer in front of a box fan. Does yours get the same number of rotations as the other groups? Use an actual anemometer to determine what actual wind speeds are in comparison to your rotations per minute.

Build your own Turbine

Each group gets one square piece of paper. Cut in diagonally from each of the four corners towards the center. Stop cutting at least one inch from the center point. Gently bend (do not fold!) one of the cut corners to the center point. Skip the next cut corner, and bend the one after it. Skip and bend until four points meet in the center. Then stick the pencil through all four points and the back of the pinwheel. Tape the end of the string to the pencil. Attach the cup to the bottom of the string. Use a paper clip to loosely attach the pencil to an index card. Make sure the index card does not interfere with the blades. Place the turbine in the pretested windy areas and time how long it takes for the cup to reach the pencil. Make additional turbines to test design variables: denser cardboard, longer/shorter propellers, number of propellers.

Review and Conclusion:

Ask the students to list ways that they can save energy in their own lives. Do any of them use wind energy at home? Many farms have historically used wind turbines to power water pumps. Have them list off at least three ways that they can save energy! What are some of the sources of energy, and are they renewable or non-renewable sources? Is all wind energy good? Touch on the benefit that renewable energy is having on the plants and animals, including us humans!!! "The plants, animals, and Mother Earth say, Thank you!!!"

References:

U.S. Department of Energy. *Energy Activities with Energy Ant*. Unknown Date. [www.eia.doe.gov / kids /] November, 2009.

The Franklin Institute. *Make your own Anemometer*. Unknown Date. [www.fi.edu/weather/todo/Dixie.html] September, 2009.

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