HOW DOES WIND POWER WORK?

LESSON SUMMARY

Wind is a powerful force that can be used to produce energy. In this lesson, students create and maneuver a pinwheel to demonstrate wind power. (45 minutes)

ACADEMIC STANDARDS

(Will populate with specifics for state)

OBJECTIVES

The student will be able to

- Identify wind power as a source of energy
- Demonstrate how windmills work
- Demonstrate how the force of wind affects the speed and direction of the windmill

VOCABULARY

Wind energy – energy the Earth receives from the wind
Wind turbine – a device that converts wind energy into electricity

BACKGROUND INFORMATION

Air moving between regions of different pressure is called wind. Temperature differences between regions, which are the result of variations in the solar energy received at the surface of the Earth, cause the pressure differences that drive winds. The rotation of the Earth also affects the direction of winds.

Wind is a powerful force that can be used to produce energy. It is a renewable energy source, which means we can use it over and over again without ever using it up. Another great thing about wind is that it does not emit any pollutants, so there is no harm to the environment.

While wind is a great free resource, we have to find a way to capture this power in order to use it for other things. Engineers have designed machines called **wind turbines** that look a little like windmills in order to do just that. You may have seen wind farms or groups of wind turbines in certain parts of your state. They most often resemble tall, white pinwheels on a large "stick". Wind turbines generate electricity by converting kinetic energy to electrical energy.

A typical wind turbine contains numerous components, many of which are made from steel, cast iron, and concrete. Some parts of the wind turbine require materials that are mined, like copper, iron, and zinc, so an increase in the number of wind turbines manufactured also generates increased need for mining.

How does a wind turbine work? The turbine's blades are connected to a gear box, which makes it spin faster and is connected to the generator. As the wind blows, the blades of the turbines spin, which turns a generator that creates electricity for our use. A turbine also has a brake in case the wind starts blowing too fast.

Include information and stats on wind energy and economic growth of industry specific to the state.

LESSON ACTIVITY

Students build their own pinwheels and then break into groups of 3-5 to answer questions.

Materials

- Computer with internet access and a projector
- Copies of the pinwheel template attached (one per student)
- Pencil with an eraser intact (one per student)
- Scissors
- Straight pin or thumb tack (one per student)

Procedure

1. Show students this video from the U.S. Department of Energy.
2. Briefly show students this image and this animation of a turbine on Energy.gov's site. Explain that they'll be building a pinwheel similar to the wind turbine.
3. Pass out **Student Activity** to students. Have them fill in the **WHAT I KNOW and WHAT I WANT TO KNOW** sections of the chart**.**
4. Then pass out pinwheel materials to students.
5. Have the students make their own pinwheels.
   - Cut along Line A and remove the bottom piece of paper.
   - Then from each corner, cut along each of the dotted lines (be sure to stop cutting once the dotted line ends).
   - Gather and fold each corner where the number is located into the center where the number 5 is.
   - Then push the straight pin through the middle of the pinwheel (where the #5 is).
   - Push the straight pin into the top of the pencil eraser. BE EXTREMELY CAREFUL that you do not stick yourself with the pin!
6. Have the students answer the questions from the **Student Activity;** follow up by discussing as a class.

ASSESSMENT

Perform the **Student Activity**; follow up with class discussion**.**

LESSON EXTENSIONS:

Have students draw their own diagram of a wind turbine based on the diagram from Energy.gov's site. How does the size of a blade on a wind turbine affect its performance? Students can explore this topic by varying the sizes of paper that they use to create their pinwheels. Try creating pinwheels out of three different sized squares and have the class calculate the area of each square of paper before building their wind turbines. Have a class discussion about how different sizes perform. This video also briefly discusses blade size.

Student Activity

Fill in the following chart as you go along in this lesson.

WHAT I KNOW
WHAT I WANT TO KNOW
WHAT I LEARNED

Create your own pinwheel using the attached template:

- Cut along the solid outline and remove the extra paper.
- Then from each corner, cut along each of the dotted lines (be sure to stop cutting once the dotted line ends).
- Gather and fold each corner where the number is located into the center where the number 5 is.
- Then push the straight pin through the middle of the pinwheel (where the #5 is).
- Push the straight pin into the top of the pencil eraser. BE EXTREMELY CAREFUL that you do not stick yourself with the pin!

How does your pinwheel work the best?

Hold your pinwheel into the wind (your breath). Next, turn your pinwheel to a 90 degree angle from the wind. How fast does it spin? Fill your answer in the chart below. Next, hold the pinwheel in a 180 degree angle (or opposite direction from the 90 degree angle) from the wind. How fast does it spin? Fill your answer in the chart below.

How you're holding your pinwheel	How fast it spins (write fast, slow, or no spin)
0°	
90°	
180°	

Based on your observations above, does placement of the windmill (with respect to the wind) have any effect on the amount of energy is produced?

Pinwheel Template