

Brief description

Studying wind turbines is a great way to learn about renewable energy generation. Students will build a working wind turbine model and then compare the amount of electricity produced by high and low wind speeds. Students will also evaluate their wind turbine design and answer questions about wind energy.

Learning objectives

- record the amount of voltage produced by varying wind speeds
- evaluate the wind turbine design
- list causes of wind
- describe the benefits of wind energy as a renewable energy source

Length of time

Two class periods

Materials

- Materials to build the Vertical Axis Wind Turbine (one turbine for every four students) as outlined in the construction plan
- A class set of the Wind Energy backgrounder and the Wind Turbine construction plan
- Wind turbine student worksheet, class set, provided at the end of this lesson plan
- One voltmeter for each group
- One fan or blow dryer for each group

Procedure

Period 1

- Distribute the Wind Energy backgrounder and have the students read the information.
- Distribute the Vertical Axis Wind Turbine construction plan and have the students read the information.
- Provide an overview of the model they will be building.
- Divide the students into groups of four. Assign them to a building centre. Distribute the magnets only when a group reaches the stage at which they are required (the magnets are very strong and can be easily be broken or become stuck to metal objects).
- Once the students have completed their models, have them try to blow on the turbine to illuminate the light.

Period 2

- Explain to the students that they will be using their wind turbine model to test different wind speeds and record the amount of electricity produced.
- Demonstrate the methods for connecting the voltmeter to the wind turbine. Ask students to apply two different speeds using a hair dryer or fan or by blowing, and to record the voltage at each wind speed.
- When the students are finished testing their wind turbines, have them complete the questions on the worksheet.



Tips and extension activities

- There is a possibility of student's turbines not working. Have a couple of extra demonstration models available so that the students can successfully test them.
- Ask the students how much wind energy is available in their region. Have students use an anemometer to measure wind speeds. Discuss whether it would be possible to use wind energy as a reliable renewable energy resource in the area.
- Have students use weather reports and the Beaufort wind scale to collect information about wind velocity and wind direction.

Comprehension

- What is the difference between a renewable and non-renewable resource?
- How does the wind turbine model generate electricity?
- Which type of wind turbine was built in class — a horizontal axis or a vertical axis turbine?
- How can wind speed affect the amount of energy produced?
- What are the benefits of using wind energy as opposed to fossil fuel-based energy?
- How was wind energy used in the past? How is it used in the present?

Answer Key

1. Which wind speed produces the largest amount of electricity — the lower speed or the higher speed?

The higher the wind speed the more volts will be produced.

2. What changes would you make to the design to improve the efficiency?

This will depend on the student.

3. What adjustments did your group have to make so that the wind turbine would run smoothly?

Students will find that lining up the rotor with the magnets so that it will skim over the copper coils is challenging. It may take a few tries for the turbine to rotate smoothly. Gluing the parts so they are straight may also be challenging.

4. Describe how wind is made.

The sun plays an important part in creating surface wind. Winds above the continents and oceans occur because of different temperatures around the world. The equator has more direct sunlight and the air is warmer than in areas close to the poles. Warm air rises and cooler air from surrounding areas fills the space left by the rising warm air, thus creating surface wind.

5. List some ways that wind power has been used in the past.

Wind energy was used for sailing ships. The wind energy provided sailors with efficient power for transportation. Wind energy has also been used to pump water and to turn a mill to grind grain into flour.



6. List some ways that wind power is used today.

Wind is used to pump water on farms, much like in the past. It is also used to generate electricity for our homes, schools and businesses. Today we have the ability to connect the electricity we generate directly to the electrical grid.

7. What are the benefits of using wind energy as a renewable energy resource?

Wind energy is a non-polluting source of energy. Farm land that has wind turbines may also be used for farming purposes. The environmental impact on land is small in comparison to that of coal mining.



Student Worksheet

First test your wind turbine and find out how much energy can be generated.

Using a fan or hair dryer, or blowing directly on the blades, apply a high wind speed and a low wind speed. Record the voltage generated by the turbine in the chart below.

	Voltage generated by the turbine
Low Speed	
High Speed	

Experiment with your wind turbine model to find answers to the following questions.

1. Which wind speed produces the largest amount of electricity — the lower speed or the higher speed?
2. What changes would you make to the design to improve the efficiency?
3. What adjustments did your group have to make so that the wind turbine would run smoothly?

Refer to the Wind Energy backgrounder to find answers to the following questions.

4. Describe how wind is made.
5. List some ways that wind power has been used in the past.
6. List some ways that wind power is used today.
7. What are the benefits of using wind energy as a renewable energy resource?

