



*Drexel-SDP GK-12 ACTIVITY*

## Activity Template

**Subject Area(s)** Measurement, Physical Science, Problem Solving, Science & Technology

**Associated Unit** Wind Turbine

**Associated Lesson**

**Activity Title** Energy from Wind

**Grade Level** 11 (10-12)

**Activity Dependency** None

**Time Required** 1.5 Hours

**Group Size** 3

**Expendable Cost per Group** \$0

### Summary

In this activity, students experiment with different wind turbine designs to determine the best design. First the students research some common wind turbine blade designs and create a list of characteristics that are common to different designs. Next the students form groups and design an original wind turbine that can be made from materials in the classroom. The students build their design and test its effectiveness using a fan.

### Engineering Connection

The energy crisis facing our world is forcing engineers to research and build devices that will generate energy from renewable sources. Wind energy is already a major source of renewable energy, but engineers are still investigating ways of improving turbines and generators. In this activity, the students are given the task of designing a wind turbine and testing its performance. The students will be able to experience first-hand how engineers approach and solve problems.

### Keywords

energy, renewable, turbine, wind

### **Educational Standards**

- Science: 3.2.B1, 3.2.B2, 3.2.B6, 3.2.B7, 3.4.C, 3.4.D, 3.4.E
- Math: 2.2, 2.3, 2.5

### **Learning Objectives**

After this lesson, students should be able to:

- Identify multiple wind turbine blade designs and explain their main differences
- Design their own wind turbine blades
- Test the efficiency of their blade design

### **Materials List**

Each group needs:

- Vernier Probe with photogate attachment
- Miscellaneous classroom materials, cardboard, aluminum foil, pencils, etc.

To share with the entire class:

- Fan

### **Introduction / Motivation**

As fossil fuels continue to be consumed at an alarming rate, we must find renewable energy sources to sustain us when fossil fuels run out. Wind energy is an important source of renewable energy that is currently being investigated by engineers. But how do engineers determine the best way to get energy from the wind. There are many questions that needed to be answered even after engineers first designed wind turbines. How many blades should the turbine have? How should the blades be shaped? Should the blades be parallel to the ground or perpendicular to the ground? Engineers have spent many years trying to answer these questions, but new designs are released every year. In this activity you will first research some wind turbine designs that are already in use. Then you will design your own wind turbine and construct it using classroom materials. Once you construct your wind turbine you will test it using the Vernier probe.

### **Procedure**

#### **Background**

Research some different wind turbine designs to find some similarities and differences between current designs.

#### **Before the Activity**

- Gather materials and probes

#### **With the Students**

1. Introduce the topic of the energy crisis and have a discussion with the class on different methods that could be used to ease our reliance on fossil fuels.
2. Give the students a brief background on wind energy if it is not included in the discussion.
3. Ask the students to research wind turbine designs. Have them find three different designs and list their similarities and differences.

4. Now have the students form groups and tell them their goal is to design an original wind turbine using materials available in the classroom. They should design their turbine so that it performs well when tested with a classroom fan.
5. Look over the students' designs before allowing them to begin construction.
6. Once the students have finished building their turbine, have the test the turbine by placing it 1 foot away from the fan and using the Vernier probe to measure how fast it spins.
7. Have the students use their data from the Vernier probe to calculate revolutions per minute.

### **Safety Issues**

- Be careful of sharp edges on any metal parts used

### **Troubleshooting Tips**

If the blades of the turbine do not fit in the photogate, the students will have to attach a small beam block to trigger the photogate.

If the Vernier probe is not available, the activity can still be done. Students should count the revolutions in a time interval to calculate revolutions per minute. It may help to place a brightly colored piece of paper on one blade to make counting easier.

### **Investigative Questions**

How does the number of blades affect the wind turbine? Are more blades always better?

How does the size of the blades affect the turbine?

### **Assessment**

#### **Pre-Activity Assessment**

*Class Discussion:* A class discussion can be used to determine the students' knowledge of renewable energy and wind turbines.

#### **Activity Embedded Assessment**

*Wind Turbine Test:* The performance of the students' wind turbine during the test stage can be used to assess the students' effort.

#### **Post-Activity Assessment**

*Lab Report:* The students should complete a lab report describing all of the steps in the scientific method that they completed in the activity.

### **Activity Extensions**

If time permits, brainstorm with the students what designs performed well and which designs did not. Then allow the students in their groups to redesign their wind turbine and test it with the changes.

### **Owner**

Drexel University GK-12 Program

### **Contributors**

Ben Pelleg, Electrical and Computer Engineering Department, Drexel University

Manuel Figueroa, Biomedical Engineering Department, Drexel University

Matthew VanKouwenberg, Science Leadership Academy, School District of Philadelphia

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