

# Harnessing Nature's Energy

**Grade level: 4-8**

**Time Frame: 1 week**

## **Objectives/Goals:**

- Understand how a wind turbine works.
- Understand and utilize the engineering process to design and construct a windmill.
- Understand that wind energy is a renewable source of energy.

## **Materials List:**

Vermier's KidWind Basic Wind Experiment Kit	\$299
3 multimeters	\$ 60
<b>Total Cost</b>	<b>\$359</b>

## **Introduction:**

Engineers continually study Earth's processes to find more efficient and environmentally friendly ways to produce electricity for our homes. Wind is a renewable resource, which means it can be used repeatedly because it is replaced naturally and readily found in nature. Wind is also earth friendly, because it does not emit any pollutants into the Earth's atmosphere. This makes wind power a great energy resource!

Wind energy is harnessed through the use of wind turbines. You may have seen wind turbines in open fields along the highway.

Check out what a wind turbine looks like, and how it works on this SaveOnEnergy link:

<https://www.saveonenergy.com/how-wind-turbines-work/>

Today, your group will design and build a wind turbine using the engineering process.

**Procedure:**

**Step 1:** Research wind turbines, paying close attention to blade design and number. Some websites to start with are listed below:

<http://energy.gov/eere/wind/how-do-wind-turbines-work>

<http://www.alternative-energy-news.info/technology/wind-power/wind-turbines/>

<http://windeis.anl.gov/guide/basics/>

Youtube video:

[https://www.youtube.com/watch?v=qSWm\\_nprfqE](https://www.youtube.com/watch?v=qSWm_nprfqE)

**Step 2:** Create a design for your group's windmill. Illustrate this design on graph paper, labeling all parts and listing the measurements for each part.

**Step 3:** Write a 4-5 sentence paragraph describing and explaining the reasoning behind your design.

**Students will present their group designs to the class. This provides a question and answer session, which helps with the design process. It also provides a chance for students to present their ideas, gaining confidence in their ideas and design.**

**Step 4:** Present your design to the class. After your presentation, discuss with your group any changes that need to be made to the design.

**Step 5:** Construct the design. Record any changes or problems that occurred during the building process in your journal.

**Step 6:** Test the completed project. Record your results in your journal.

**Two tests will be conducted on the finished product to measure turbine output:**

### **Multimeter**

Connect the positive terminal wire of the generator to the red wire of the multimeter and connect the negative terminal wire to the black wire of the multimeter. Set the multimeter to measure DC voltage at the lowest setting. The number shown on the multimeter is the amount of electrical potential, measured in volts that the turbine generates. The energy being produced is proportional to the voltage. If there is no reading, shift the setting to the next higher voltage setting. Keep doing this, as needed, until you get a voltage reading.

### **Lifting weight with wind energy**

1. Tie the string to the spool, taping it down so it does not slide. Add one hex lock to each end of the spool, pressing them into the spindle hole.
2. Affix the plastic bucket to the other end of the string, using the holes pre-drilled in the bucket.
3. Remove the 32-tooth gear from the hex shaft. Push the spool onto the hex shaft.

**Step 7:** Share your results with the class. Record the data from all groups in your journal, and discuss within your group which turbine was the most efficient?

### **Assessment:**

**Step 8:** Complete the following journal questions.

1. List 5 things that your group learned about wind energy, turbines, energy testing, engineering and design, or sustainability.

2. Which turbine did your group decide was the most efficient? Explain your reasoning.
3. What was the most difficult aspect of this project, and how did you overcome it?
4. How did your design change over time? What were the differences between your initial design and your final design? Why did your group decide to make these changes?
5. If you were to do this project again, what would you do differently?