

Light Wind

Build a simple wind generator

Recommended Grade Level: 6-12

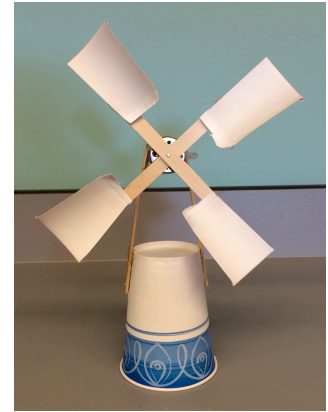
NGSS Science & Engineering Practices:

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Designing solutions

Time: 15 min prep, 45 min activity

Materials Needed:

- small hobby motor – higher voltage ones give better results (Jameco #1955669 works well)
- red LED; high-intensity ones are easier to see (inexpensive online at Jameco or Tayda Electronics)
- 4 craft sticks
- small cup or other material for blades
- medium cup for base
- glue gun
- scissors
- drill and bit the size of the motor shaft (we use AWG#50)
- fan or windy day
- (optional) other motors and LEDs, hookup wire, alligator clip leads

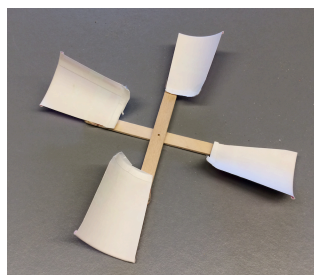
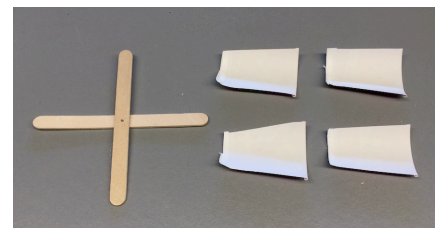


Background Information

This activity is adapted from one we saw by Joel Weber at the CuriOdyssey museum at Coyote Point. Check them out at: <http://www.curiodyssey.org>

To Do and Notice

1. Cut the small cup vertically into four equal parts. Remove the base of the cup to create four curved pieces that will be the blades of the wind generator.
2. Use hot glue to attach two craft sticks together so that they make a plus sign. Once the glue is dry, drill a small hole the size of the motor shaft in the center of the craft sticks. This will serve as the frame for your blades.
3. Glue a blade to each end of the craft stick. The blade design has the greatest impact on the efficiency of the wind generator. Below is just one way to do it. Use whatever materials you have on hand to construct something you think will best utilize wind to yield the most rotations per second.
4. Attach an LED to the back of your motor. Slide your blade frame onto the shaft of the motor.



5. Make a stand to hold your motor using the other two craft sticks and the larger cup or whatever materials you have available. Make sure your stand does not obstruct the ability of the blades to turn freely. This one holds the motor in a fixed position. Some wind generators allow the blade frame to rotate to optimize its position depending on the wind direction. Can you design a stand that will turn into the wind?



6. Test out your wind generator with a fan or a windy day. Can you generate enough power to light an LED? Note: LEDs only work in one direction in a circuit. Your motor will output DC current, but it may be in the reverse of the direction your LED needs. If you have trouble getting the LED to light up, try switching the leads to make sure it's connected in the correct orientation.

What's Going On?

A generator is a device that converts mechanical energy into electrical energy. It is the reverse of a motor, which uses electricity to create motion. This activity uses a hobby motor in reverse to create a current. By attaching blades to the motor, wind can be used to provide mechanical energy to the motor so that it works like a generator and supplies electricity. This electricity could be measured with a multimeter, but an LED provides an easy readout that shows power is being generated. This simple wind generator is a model for wind turbines used to generate electricity around the world. Though they operate on a larger scale, they use the same physical principles to convert wind energy to electricity.

Going Further

Two key NGSS Engineering Practices are defining problems and designing solutions. This activity provides a basic template for constructing a wind generator. By using a high voltage motor, the wind generator should easily light a red LED with a room fan. In addition to designing a stand that can rotate into the wind, three challenges to explore are:

- 1) designing a generator that works with a lower power motor
- 2) designing a generator that works in a light wind
- 3) designing a generator that will power a device that requires more voltage or current, like a holiday light

What adjustments can you make to the blade design that will solve these problems?

When design testing, it can help to make the parts of the wind generator modular so things can be readily swapped in and out. You can use alligator clip leads or hookup wire to make it easier to swap out the LED if you are testing different load devices. Can you design an easy way to test different wind blades?