

Wind Turbine

Overview: We'll take a look at propeller design as we build a working wind turbine.

What to Learn: We use all kinds of resources to meet our energy needs. You'll learn how wind energy is so important, and the principles behind how energy is converted so that we can use it.

Materials

- A digital Multimeter (Radio Shack #22-810)
- Alligator clip leads (RS#278-1156)
- 1.5-3V DC Motor (RS #273-223)
- 9-18VDC Motor (RS #273-256)
- Bi-polar LED (RS #276-012)
- Foam block (about 6" long)
- Scrap piece of wood for mounting
- Propeller from old toy or cheap fan or Radio Shack Solar Kit 277-1201.
- Sharp knife or scissors
- Hair drier
- Hot glue gun

Lab Time

1. Slice the foam block in half lengthwise. Adult supervision is needed! Stack the two pieces and hot glue them together.
2. Mount your blocks on a piece of wood or sturdy paper. Next, attach your motor to the top of the foam. Make sure the shaft is overhanging the edge, because we want to attach a propeller.
3. Attach the propeller to the shaft of the motor, and make sure it is able to spin freely.
4. Mount the solar cell onto your base, and wire the motor into the appropriate places on the solar cell.
5. Go outside and give the cell a test, making sure the propeller spins according to the amount of sunlight.
6. Disconnect the wires and set the solar cell aside. Take your LEDs and spread their metal wires so that you can stick them into the foam block below your propeller.
7. Take alligator clips and attach them to the wires of the motor. Make sure the clips are attached to the wires themselves, not the insulation.
8. We need to figure out if the wires are connected properly. Use a hair dryer on the lowest heat setting, highest power, to spin the propeller. Experiment to find the sweet spot where the propeller will spin well. If your LEDs do not light up, try using the hair dryer on the opposite side, behind the motor. Does it work? If not, then reverse the wires.
9. Disconnect the alligator clips from the LEDs and attach the multimeter to the motor. Click the dial three times to the left to get the right range of voltage. Use the hair dryer again and record your reading from the multimeter on your worksheet. What about if you arrange the dryer to blow from the other side?

Wind Turbine Data Table

Wind Direction or Configuration	Reading (Voltage)
Front of propeller	
Rear of propeller	

Believe it or not, most of the electricity you use comes from moving magnets around coils of wire! Wind turbines spin big coils of wire around very powerful magnets (or very powerful magnets around big coils of wire) by capturing the flow.

Here's how it works: When a propeller is placed in a moving fluid (like the water from your sink or wind from your hair dryer), the propeller turns. If you attach the propeller to a motor shaft, the motor will rotate. It has coils of wire and magnets inside. The faster the shaft turns, the more the magnets create an electrical current.

The electricity to power your computer, your lights, your air conditioning, your radio or whatever comes from spinning magnets or wires!

Reading

Wind power is a recently burgeoning source of renewable energy. Although we've invested in large-scale wind power in North America for the past forty years, recent projects in northern and central Europe have constructed the most massive arrays yet seen. In the North Sea, massive floating turbines generate enough electricity to power thousands of homes. Although legal and environmental challenges restrict how much we can build wind farms (they are quite a hazard to migrating bird populations, and even have effects on livestock and human settlements near them), they will provide an important part of our future energy needs.

Exercises Answer the questions below:

1. True or false: Electricity in a wind turbine is created by magnets in the turbine:
 - a. True
 - b. False
2. What is one advantage of using wind for electricity?
3. What might be one problem with constructing wind farms to meet all our energy needs?

Answers to Exercises: Wind Turbine

1. True or false: Electricity in a wind turbine is created by magnets in the turbine: (true)
2. What is one advantage of using wind for electricity? (no pollution, less reliance on fossil fuels)
3. What might be one problem with constructing wind farms to meet all our energy needs? (might kill birds)