UN environment programme

SUSTAINABLE DEVELOPMENT GOALS

GOETHE INSTITUT

Science Film Festival Knowledge Through Entertainment

BUILD YOUR OWN WIND POWERED GENERATOR

KEY OBJECTIVES

1. **To learn about clean energy**
2. **To understand how electric power is generated**
3. **To know that recycled materials can make a new useful thing**
4. **To make students curious and be able to dig further**

INTRODUCTION

An electric generator is a device that converts one form of energy (usually mechanical energy) into electrical energy. This is the opposite of how a motor works, which uses electricity to create motion. This activity uses a DC motor in reverse to create an electric current. By attaching blades to the motor, wind, water or any other force applied on can be used to provide mechanical energy to the motor so that it works like a generator and supplies electricity. This electrical output 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.

GUIDING QUESTIONS

1. **When you motor ran as a motor, a little power made it spin quickly - so when we use it as a generator, it will need to spin quickly to make a little power. Can you get your machine to spin very quickly? What do other machines use to change how quickly something spins? Do you have gears on your bike?**
2. **Test out your wind generator with a fan or on 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.

MATERIALS

- **Small DC motor, 3-12 volts**
- **Red, high-intensity LED**
- **Four craft sticks**
- **Small paper cup for fan blades**
- **Medium cup for base**
- **Hot-glue gun and glue**
- **Scissors (not shown)**
- **Drill**
- **Fan or windy day**
- **Optional: other motors and LEDs, hookup wire, alligator clip leads**

CONNECTION TO SDGS

TOPICS

EARTH SCIENCE | ENGINEERING & TECHNOLOGY | DESIGN & TINKERING | MECHANICS | LIGHT | REAL-WORLD PROBLEMS & SOLUTIONSNOLOGY | PHYSICS | ELECTRICITY & MAGNETISM | ENERGY

CROSS LINKS

SDG 13 : Climate Action

KEYWORDS

ALTERNATIVE ENERGY | DC MOTOR | LED | RESISTOR | SHAFT | TOOL

LEVEL

Secondary Level

RESOURCE TYPE

DEMONSTRATION | PROJECT

INTENDED AUDIENCE SIZE

This will depend on the materials we will have and sanitation majors. If students could not be group in a team and need distance between them so the audience will also depend on the space we will have

MODE OF DELIVERY

Large venue setting, small group

TIME FOR ACTIVITY

45 min.

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TASKS

1. Cut the sides of the small cup into four equal parts. Remove the base to create four curved pieces that will be the blades of the wind generator.
2. Use hot glue to attach two craft sticks together at the center so they make a plus sign.
3. 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 (see below).

4. Glue a blade to each of the craft stick ends, as shown (click to enlarge image). The blade design has the greatest impact on the efficiency of the wind generator; this is just one way to do it. Feel free to try materials other than a cup to construct something you think will best utilize the wind to yield the most rotations per second. Look closely at the blades of a fan, are they flat, or angled, what effect does this have? How will you set up your blades?
5. The DC motor should have two small prongs sticking out of the back that serve as the terminals where you would normally attach a power source. Instead, attach an LED to the back of your motor by twisting each leg of the LED through a different terminal on the back of the motor. The correct orientation of the LED will depend on whether the blades spin clockwise or counterclockwise, so you will know if you need to switch it once you test the windmill. Slide your blade frame onto the shaft of the motor (see below).

6. Glue one end of each of the other two craft sticks on either side of the larger cup to make a stand that holds the motor above the cup like chopsticks. Glue the other ends of the craft sticks directly to opposite sides of the motor to hold it in place. Make sure the motor is positioned so that the stand does not obstruct the ability of the blades to turn freely.

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FOSTERING DISCUSSIONS

This hands on activity provides a basic template for constructing a wind generator, but there are many opportunities to engineer a better design. What adjustments can you make to the overall design to solve these problems?

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

By using a high voltage motor, the wind generator should readily light a red LED with a room fan. Can you design a generator that works with a 3-5V motor? 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?

The principle behind this activity is to move the shaft (made with coil) of the motor into a magnet field created by magnets that are made in the motor. What could be another mechanical force that can be applied to move the shaft rather than the wind? These DC motor can be found in baby toys car, in CD ROM DVD and other different materials. What do you think if you recycle different devices to make cool and innovative gadgets?

SAFETY INSTRUCTIONS

Set of instructions about the safety of a drill press on the link bellow
https://www.lsu.edu/eng/mie/cuf/ammf/safetyrules/DrillPress.php

POSSIBLE EXTENSIONS

If you have water running is a stream, could you use the energy of the water to spin the generator, can you adapt other machines to help make a more powerful generator, and old bike? a toy, and old battery powered drill?

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