

Designing a Windmill

Alternative Energy Systems Corporation is accepting design proposals to develop a windmill that can be used to lift window washers to the tops of buildings. Your division of the design engineering team has been asked to develop a working model for such a windmill. Your task is to design and build a model that can lift 30 large paper clips a vertical distance of 50 cm. The job will be given to the team whose model can lift the paper clips the fastest.

WHAT YOU'LL DO

Prepare a detailed sketch of your solution to the design problem.

Design and build a functional windmill that lifts a specific weight as quickly as possible.

WHAT YOU'LL NEED

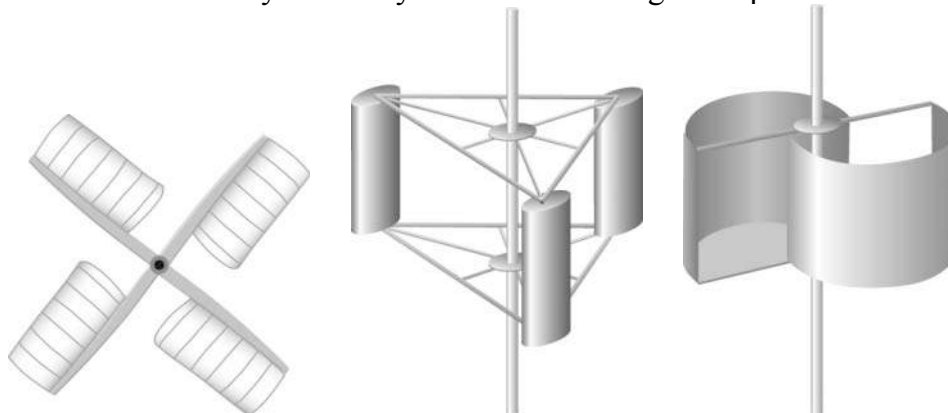
- blow-dryer, 1,500 W
- dowel or smooth rod
- foam board
- glue, white
- paper clips, large (32)
- paper cup, small (1)
- paper plates, paper cups, wooden popsicle sticks, and any other lightweight materials out of which to make windmill blades
- stopwatch
- string (70 cm)
- tape, masking

SAFETY



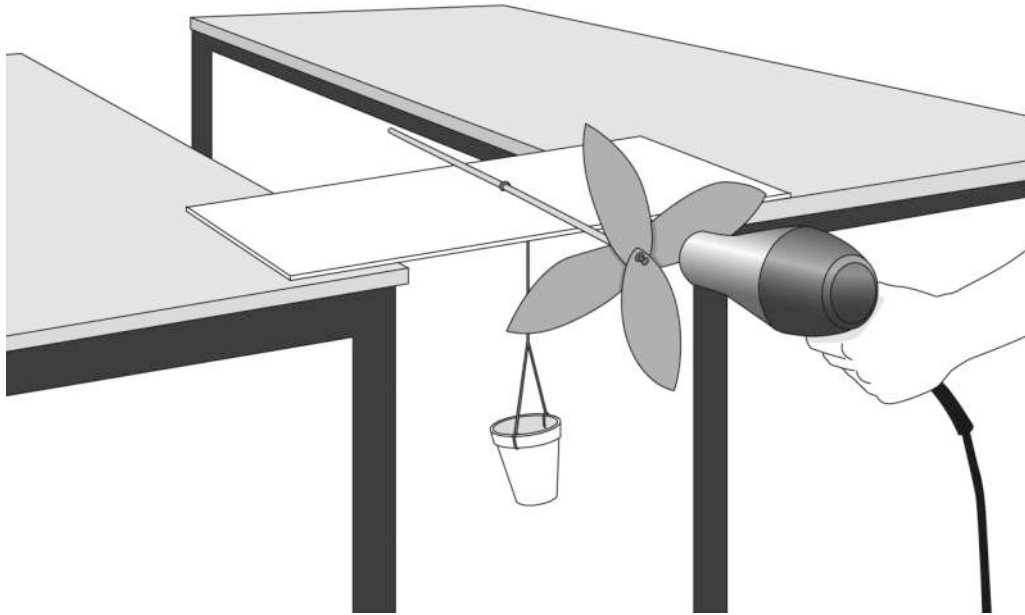
PROCEDURE

1. With a partner or small group, brainstorm a windmill design which uses only the objects listed in the materials list. Sketch your design, and write a few sentences about how you think your windmill design will perform.



Designing a Windmill *continued***Performing Your Experiment**

2. Have your teacher approve your design before you begin construction. Build the base for your windmill by taking two straightened-out paper clips, making a loop with each one, and sticking the ends into the foam board. Make sure that the loops line up with each other, and pass a dowel rod through them. The dowel should rotate freely. Attach one end of the string securely to the dowel between the two loops.



3. Poke a hole through the middle of the foam board to allow the string to pass through. Place your windmill base between two lab tables or in any area that will allow the string to hang freely.
4. After you have decided on your final design, attach the windmill blades to the base.
5. Attach the cup to the end of the string. Fill the cup with 30 paper clips. Turn on the blow-dryer, and measure the time it takes for your windmill to lift the cup.
6. If you have time, you may want to try using different materials to construct your windmill blades. Test the various blades and configurations to determine whether they improve the original design.