

Kit Materials

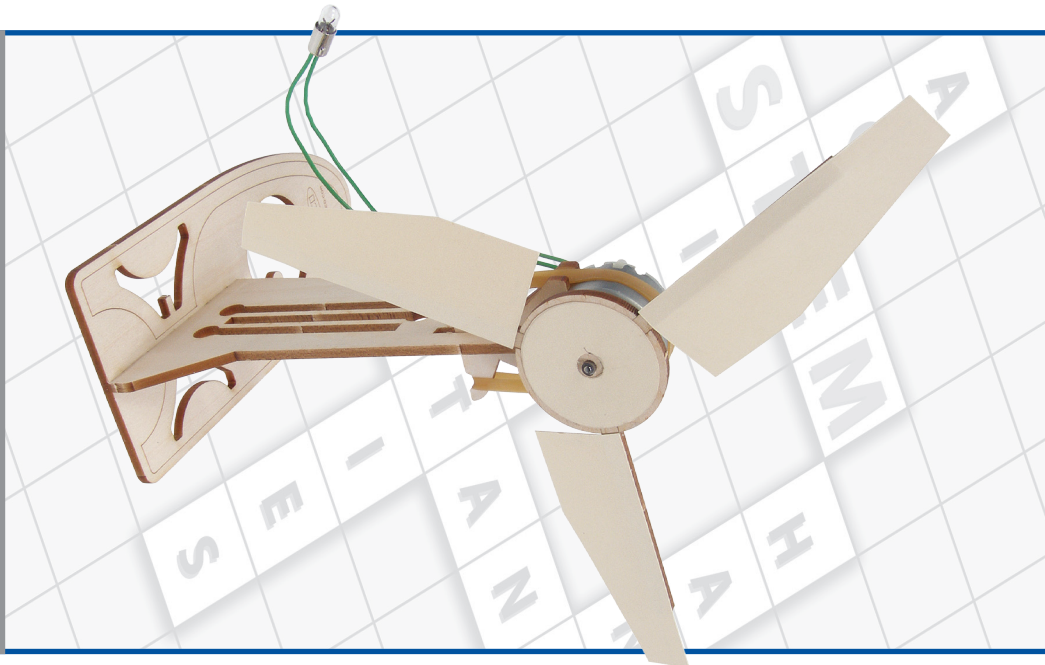
- 1 quarter sheet of card stock with circles and blades printed on it
 - 1 motor with lightbulb attached (pre-soldered)
 - 1 sheet of wooden laser-cut parts
 - 1 piece of small tubing
 - 1 rubber band
- If anything is missing from the list of materials, call 800-358-4983.

Materials and Tools Required (not included)

- White glue, preferably with a fine-point applicator tip
- Glue stick
- Scissors
- Electric fan or source of wind
- Waxed paper
- Masking tape
- Hobby knife or single-hole punch

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User Guide

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**Wind Gen
Kit**

Cautionary and Warning Statement

- This kit is designed and intended for educational purposes only.
- Use only under the direct supervision of an adult who has read and understood the instructions provided in this user guide.
- Read warnings on packaging and in manual carefully.
- Always exercise caution when using sharp tools.

How Windmills Work

Move a conductor through a magnetic field to cause free electrons in the conductor to flow. This flow of electrons is electricity and it is the principle at work here. In this kit, a small lightbulb proves that windmills can generate electrical power.

How does it work? A DC (direct current) motor contains permanent magnets that provide a magnetic field. It also contains an armature, a series of coiled wires that rotate within the magnetic fields. When the shaft of the motor is turned by wind blowing on the wind generator blades, the wires in the armature pass through the magnetic field, pushing electrons through the wires to produce electricity.

It's also important to understand pitch. Pitch refers to the angle of the blade away from the plane of rotation. By bending the blade back a little, the wind moves the blade easier. Without any pitch, the wind may not move the blades much at all.



Modern windmills

Photo courtesy of MorgueFile.com

Winds of Time – Windmills in History



Older windmill

Photo courtesy of MorgueFile.com

Windmills made agriculture and ranching possible in remote, rural areas of the prairies. They harnessed the power of the wind to draw water from wells, moving a sucker rod up and down inside a cylinder below water level. This motion pushed water up a pipe and into a holding tank. The water was used for livestock, household needs, and crop irrigation.

Use of windmills declined as electricity from coal-burning plants came to rural areas in the 1930s. Today, we are rediscovering the efficiency of wind power as large, modern turbines are turning up across the country and in coastal waters. In 2011, the United States' production of wind-generated electricity reached 47,000 megawatts, or enough to power 12 million homes for a year. The Department of Energy says that 20 percent of the United States' total electricity could come from wind energy by 2030 with continued tax credits.

Building the Wind Generator

1. On the area where you intend to work, spread a piece of waxed paper and tape it down to the surface. This will prevent glue from getting on the work surface.
2. Using scissors, carefully cut out the circles and the blades from the card-stock sheet. Using a hobby knife or hole punch, cut out the small circle in the middle of each card-stock circle. You can cut or punch the circle a little bigger than it is drawn.
3. Carefully, pop out the laser-cut parts from the wooden sheet. Find the three Part 6s and Part 5. Set aside all the other parts.

Step 2



4. Glue the rounded end of each Part 6 into one of the holes around the perimeter of Part 5.

5. When dry, glue a card-stock circle centered over Part 5. Press it firmly down and turn it over. Repeat with the other circle.

6. Using a glue stick, glue the blades on the edges of the Part 6s. Make sure the printed side of the blades is facing down and the straight side is aligned with the edge of the Part 6s. Let dry.

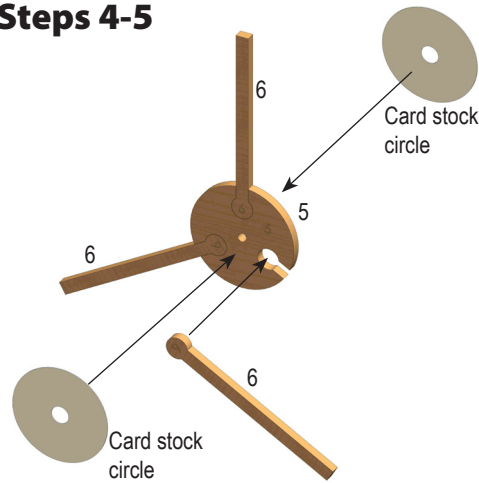
7. Find Parts 2, 3, and 4. Glue the two Part 3s on top of Part 2 as shown.

8. Glue Part 4 onto Part 2 in the slot under the Part 3s as shown.

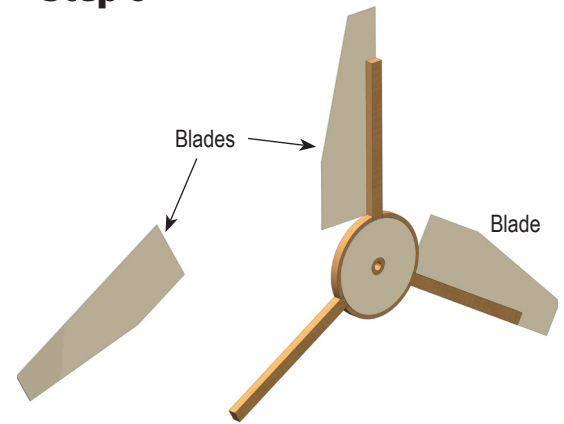
9. Glue the other end of Part 2 into Part 1 as shown; this makes the stand. Let it dry.

10. Place the motor on top of the stand with the motor post facing toward the straight edge of Part 1. Loop one end of the rubber band over one side of Part 4, pull it over the motor, and hook the other end on the other side.

Steps 4-5



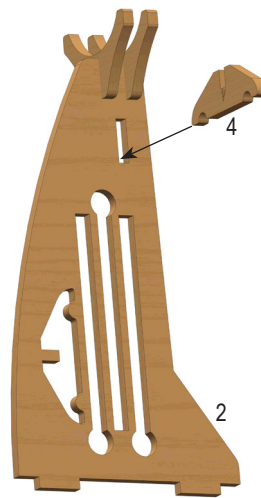
Step 6



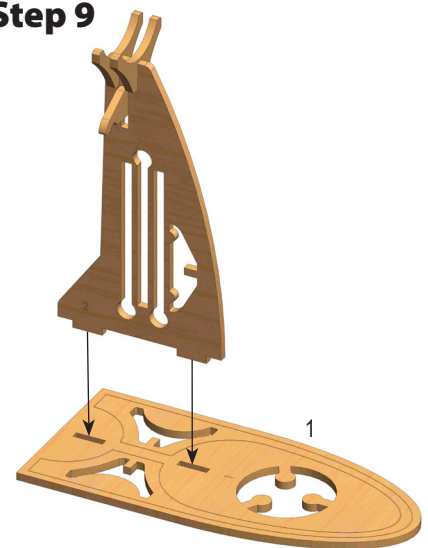
Step 7



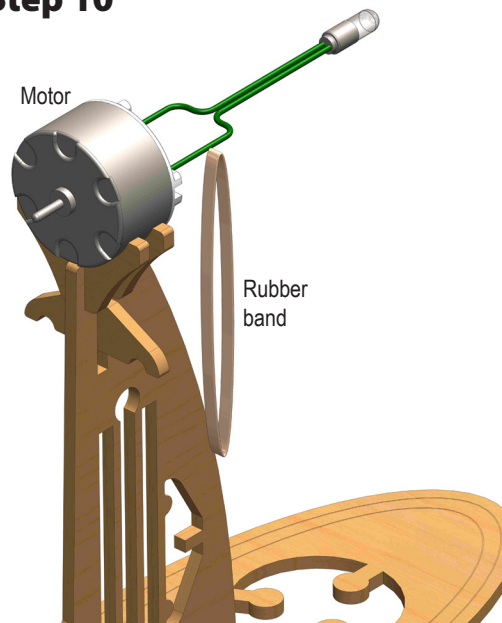
Step 8



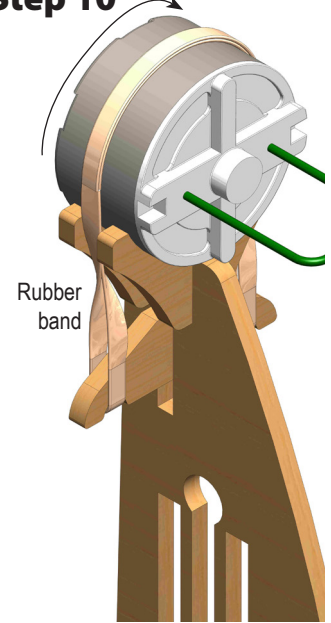
Step 9



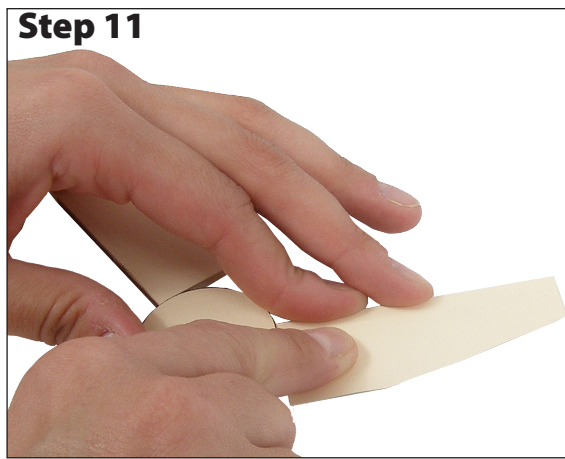
Step 10



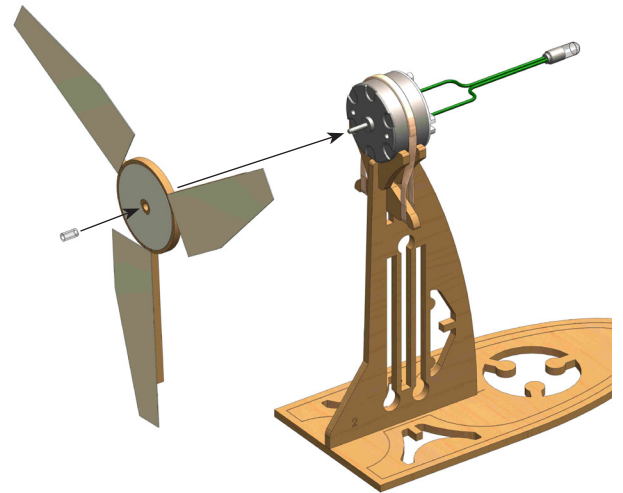
Step 10



- When the blades are dry, take the blade assembly and rub along the edge where a blade is attached to a Part 6. Repeat this for all three blades. This will create a slight pitch in the blade so the wind can move the blade easier.

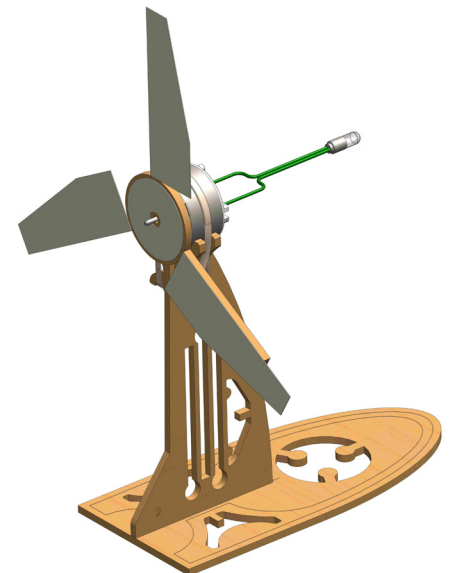


Steps 12-13



- Push the piece of tubing through the center hole on the blade assembly. **Note:** If the tubing is longer than 1/4", trim it to that length.
- Push the blade assembly onto the motor post until the post extends just past the front of the blade assembly. Be sure the unprinted side of the assembly is facing forward.

Completed model



Using the Wind Generator

- Set the wind generator in front of a fan. It is recommended to secure the Wind Generator to the table or floor with masking tape to keep it from blowing over.
- Turn on the fan to a low setting, making sure the wind generator is close to the fan and in the middle of the airflow. If the wind generator does not turn, set the fan to a higher setting.
- Watch as the wind generator starts to turn and lights the bulb.

Experiments

- Use a multimeter to measure the voltage at different wind speeds and record the results in a data table. Graph the results.
- Wire two or more wind generators together in series and in parallel to see what effect there is on the bulb lighting.
- Measure the voltage of different numbers of windmills wired in series and in parallel. Record the measurements in a data table and graph the results.
- Have a class of students build a wind farm. Wire it in series and parallel to produce a voltage of nine volts. Use the wind farm to power a radio, motors, or other nine-volt items.
- Have students describe how a large-scale wind farm could provide power for homes and industry.