



Make a Windmill

Grade: 3-5

Subjects: Science, Social Studies

Time: 60-90 minutes

***Standards:** Students will ...

Technology Standard 4: Understand the nature of technological design.

Benchmark # 6: Use appropriate tools, techniques and quantitative measurements to implement proposed solutions.

Science Standard 12: Understand the nature of scientific inquiry.

Benchmark # 3: Plan and conduct simple investigations.

Geography Standard 16: Understand the changes that occur in the meaning, use, distribution and importance of resources.

Benchmark # 1: Know the characteristics, locations and uses of renewable resources (e.g., water, wind, solar, geothermal, biomass) and non renewable resources (e.g., fossil fuels).

History Standard 8: Understand major discoveries in science and technology, some of their social and economic effects, and the major scientists and inventors responsible for them.

Benchmark # 3: Know various technological developments to control fire, water, wind, and soil, and to utilize natural resources (e.g. trees, coal, oil, gas) in order to satisfy basic human needs.

Benchmark # 14: Know the significant scientific and technological achievements of various historical societies.

Objectives: Students will be able to...

- Describe how windmills work and their impact on the environment over time.
- Identify and describe wind power as a renewable energy source.
- Make observations, collect and record data, and draw conclusions on wind power based on the operations of a model windmill.

[Please click here to view both the creative artwork for this great lesson and the downloadable PDF.](#)

Materials:

- Pictures of windmills (past to present)

Per Windmill:

- Paper
- Pencil (sharpened)
- Hole punch (optional)
- Markers or crayons



- Two rubber bands
- Drinking straw
- Small paper cup
- 20 inch string
- Scissors
- "Make a Windmill" template provided below

Overview: The earliest known use of wind to produce energy is approximated around 3,500 BC when the Egyptians are said to have used it to propel their sailboats through the water. Some 1,500 years later, as early as 2,000 BC, windmills were used to pump water and by 600 AD to process grains into flour. At some point in the 1300's the horizontal-axis windmill (similar to a pinwheel) appeared in Europe and was used in the Netherlands to drain fields and in France to irrigate them. By the late 1800's windmills were in use across North America pumping water. Steel blades had been introduced to improve efficiency. In 1888 a windmill was used in Cleveland, Ohio to generate electricity for the first time, and the term "wind turbine" was called into use. Now in the 21st century growing concerns regarding environmental problems, such as air pollution and global warming, have moved interests in renewable energy sources, of which wind power is a substantial contributor, to the forefront. 2008 estimates have global wind energy productions exceeding 94,000 megawatts of power.

A wind turbine, a more advanced version of the windmill, is a machine that converts the movement of the wind into electricity. The wind is used to turn the blades of the turbine, which in turn spins the turbine's shaft. The shaft is connected to a generator that changes the energy of the wind into electricity. The electricity is sent through transmission lines to a substation, which routes it to other sources, such as homes and businesses.

One wind turbine can produce anywhere from 100 watts to five megawatts of electricity. To increase output and produce larger amounts of electricity wind turbines can be clustered together in an area. These clusters of wind turbines are known as wind farms. Using wind farms to generate electricity is very economical and considered to be one the most cost effective methods used today.

Kid's Speak: Windmills have been used for thousands of years. They catch the power of the wind and use it to help make our work easier. In earlier times windmills were used to pump water and process grains into flour, and in 1888 a windmill was used for the first time to create electricity. Today, windmills are used all over the world to generate electrical power. Windmills that change wind energy into electricity are called wind turbines. Large groups of wind turbines, all clustered in the same general area, are called wind farms. These wind farms are used to make large amounts of electricity. This not only helps to save the environment, but also helps to keep the cost of making electricity down.

Eco-Fact: The largest windmills in the world are as tall as 20 story buildings and have blades as long as football fields.

Procedures:

Before Making Windmills:

- Lead a discussion on windmills. Show pictures of windmills from early times to present day. Discuss how windmills have evolved in appearance and in use over time. Discuss the benefits of windmills, past and



present.

- Show the students a sample of the windmill they are about to make. Have them predict what will happen to the cup when the wind moves the blades of the windmill. Record responses.

Making Windmills:

1. Divide the class into groups of two or three students. Have each group cut out the windmill template provided.
2. Using a sharpened pencil or hole punch, poke a hole through the circle at the center of the template and the circles in each of the four corners.
3. Color in one of the four quadrants in a dark shade. This will be the blade of the windmill that helps indicated the number of rotations.
4. Making sure not to cut the center circle, cut along the solid lines of the template.
5. Slide a straw through the center of the template. Fold the template along dotted lines while sliding the straw through the hole in each corner.
6. Secure the windmill around the base and top of the straw using rubber bands (or tape).
7. Blow on the windmill blades to make sure they can spin. Adjust as necessary.
8. Punch two holes, equidistant from one another, into the sides of the paper cup. Thread the string through both holes. Tie one end of the string to the middle of the string, and tie the loose end to the top of the straw attached to the windmill.

Using the Windmills:

1. Have students hold each end of the windmill's straw, so the straw is vertical and the paper cup is hanging down towards the ground.
2. Tell students to blow on the windmill's blades, and watch the wind created move the blades and raise the cup hanging above the ground.

After Using Windmills:

- Refer back to the student's predictions of how the windmill would work. Were they correct in their assumptions? What happened that was different than their predictions?
- Have students create a diagram of the windmills at work. Tell students to label the diagram to explain how wind moved the windmill and created energy to raise the cup.

Adaptations:

- Students can remove the cup from the windmill, take it outside and count the number of rotations it makes in one minute. Students will count the shaded blade each time it spins around to find the number of rotations in the given timeframe.

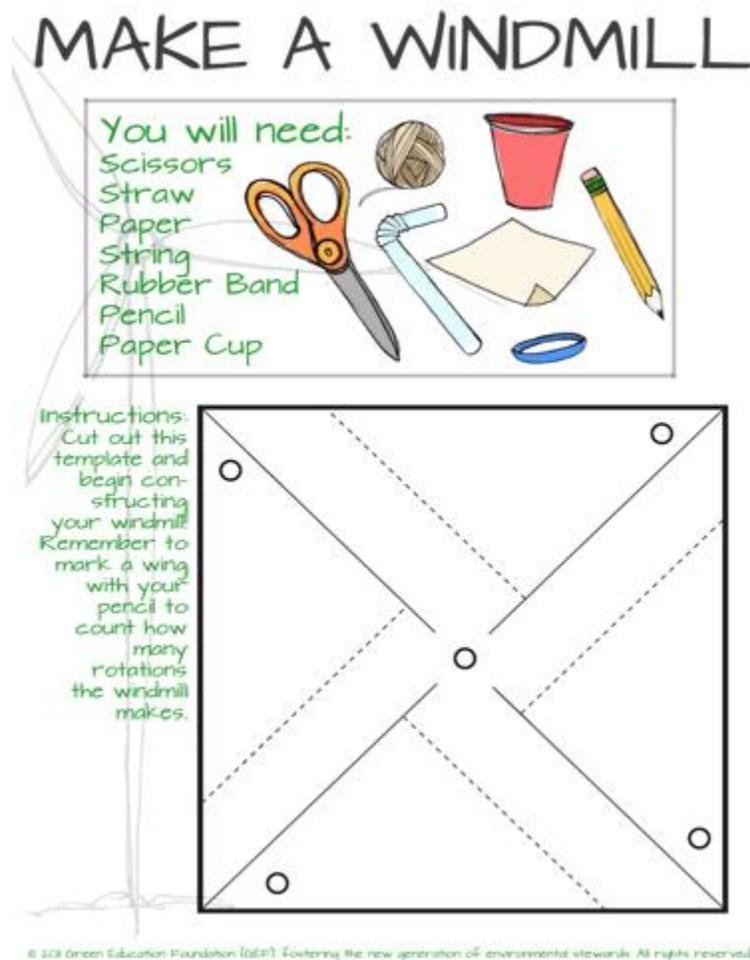


- Each student can make his own windmill to use in the experiment.
- Older students can design their own windmills.

Extensions:

- Have students visit or research a wind farm.
- Read "Wind Power (Energy for Today)" by Tea Benduhn
- Have students research and develop a timeline showing the changes in wind power usage overtime.

GEF Community: Join the GEF Community! First, add your school, class or group as a GEF member. It just takes a minute and your students will learn about technology and social networking all in one. Use your class or group page to keep a record of your students' projects, ideas, photos, etc. You can share them with other schools across the nation. Simply, complete the basic information and then join the Green Energy Challenge. Share your windmills and your experience making them.





To view full-size illustration click on image above.

To print or email as a PDF follow these instructions:

1. Click on the image above to open
2. Then, click on the small "print" icon located on the upper left side
3. Set the "Page Scaling" option to "Fit to Printable Area"
4. Click "OK" to print!
5. To save or email click on the second icon from the print button and save to your computer, then enclose in an email and send.

For technical assistance with printing any of the GEF lessons, please contact service@greeneducationfoundation.org

© 2011 Green Education Foundation (GEF) Eco-Challenge Series All rights reserved.
Fostering the new generation of environmental stewards.

* All lessons listed on the GEF website have been aligned with the McREL Compendium of Standards and Benchmarks for K-12 Education. GEF curriculum has been developed in accordance with the McREL standards in order to reflect nationwide guidelines for learning, teaching, and assessment, and to provide continuity in the integrity of GEF curricular content from state to state. The decision to utilize McRel's standards was based upon their rigorous and extensive research, as well as their review of standards documents from a variety of professional subject matter organizations in fourteen content areas. Their result is a comprehensive database that represents what many educational institutions and departments believe to be the best standards research accomplished to date. To access the McREL standards database, or for additional information regarding the supporting documentation used in its development, please visit <http://www.mcrel.org>.