

Questacon at HOME

Energy Activity Sheet

Wonderful Windmills

BACKGROUND

Wind energy is a renewable energy source – wind is always occurring somewhere on Earth, and it is because of this that the use of wind power for work has been around for such a long time. In the past, windmills have been used to grind grain into flour or pump water. However, more modern windmills, called wind turbines, have harnessed wind power to create electricity. Next time you are out in the car driving outside the city, keep your eyes peeled for these towering electricity creators.

MATERIALS

- 1 clean 2L plastic bottle
- 1 wooden skewer (with sharp tip cut off)
- 1 drinking straw
- 1 sharp pencil
- Sticky tape
- A piece of thick cardboard
- A sheet of A4 construction paper

SAFETY

Activity to be conducted under adult supervision. Creating the hole in the bottle and cardboard requires using sharp objects and should be done by an adult.

PROCEDURE

The plastic bottle will be the tower for your wind turbine tower. Using the sharp pencil, poke a hole straight through both sides of the neck of the bottle. Cut the straw to a length of around 15cm, ensuring it is long enough to push straight through the holes you made in the bottle. Once you have pushed the straw through the bottle, push the wooden skewer through the straw. The skewer should have enough space to turn freely, and this will act as your wind turbine shaft.

Use the inside of your sticky tape spool as a template for creating a circle with a diameter of approximately 7cm on your piece of cardboard and on your piece of construction paper. Cut both circles out. Fold the paper circle in half and then into quarters. Unfold the paper circle and place it over the top of the cardboard circle. Use this as a template for you to mark the centre point of the circle and also four exact quarter points, which is where you will place your blades. Draw a 2.5cm straight line from each of the quarter points toward the centre, and cut along the lines. You can then discard the paper circle.



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Using your sharp pencil again, make a hole in the centre of the cardboard circle, then push the circle onto the wooden skewer in the bottle (you may need some tape to hold it in place).

To create the blades of your wind turbine, take the remainder of your construction paper and cut out four rectangular pieces, approximately 11cm x 4cm. Fold the pieces in half lengthways then slide them into the incisions you made in the cardboard circle. Again, secure with tape if needed.



TIPS AND TRICKS

- Test the turbine using your breath or the breeze outside. If there is no wind, use a fan or a hairdryer.
- Try tying a piece of string to the other end of the shaft. See if you can generate enough spin for the shaft to turn and wind-up the string.

WHAT'S THE SCIENCE?

Wind energy can be a powerful and valuable source of kinetic energy. Wind energy comes from the sun's uneven heating of the earth's surface – as hot air rises, cool air moves in to fill the gaps in a process called **convection**. It is this air movement that is defined as wind. The principle behind how wind turbines operate is a simple one. The energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which, when it spins provides power to a generator to create electricity. A group of wind turbines, called a wind farm, can provide electricity to a small community. Did you know that 8.5% of Australia's current electricity generation is created by wind energy? While the use of wind energy has the advantage of being renewable with zero emissions, they are not always reliable and any electricity that is generated must be stored which can be an expensive process. Nevertheless, the wind industry is booming – and with it the hope that wind energy can meet the demands of a growing global population.

WHAT QUESTIONS COULD I ASK?

- Do the windmill blades need to be bent/curved? Would it work with flat blades?
- What happens if I change the number of blades (more or less) – what impact will it have?
- For wind turbines to be used, what kind of environment should they be built in?

WHAT'S NEXT?

Mix it up: What happens if you don't use paper for the blades? Could you think of another material to use?

Other kinds of energy: The turbine design is not just utilised in wind power – but also in energy generation involving hydro (water) and steam. Can you design a water-proof turbine that can be used with both water and steam (Safety: steam is hot and experimentation should be done under adult supervision)

Design and purpose: Could you design a wind turbine that changes direction with the wind?

What about wave power: Could waves make electricity?

When experimenting, saying "I don't know" is ok - solving problems is about curiosity and finding things out. If we always knew the answer we would never learn anything new!

