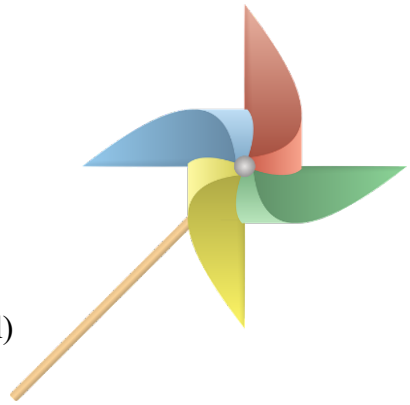
Virginia 4-H STEM @ Home Activity

Build a Windmill

Supplies:

- Card stock
- Scissors
- Sharp pencil or push pin
- Pipe cleaner (chenille stem)
- Plastic straw
- Tape
- Small cup
- String or Dental Floss
- Pennies or other small objects
- Crayons or markers to decorate your turbine (optional)
- Blow dryer or box fan



Age: 5 and up

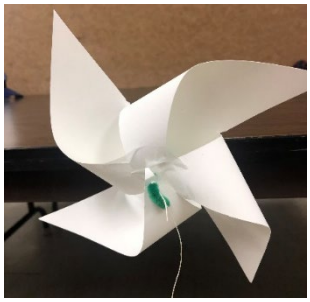
Time: 30 minutes

Background: A windmill (used for water) or wind turbine (used for electricity) is a machine that can provide a source of power. For over 3000 years, windmills have been used to pump water and grind grain. More recently, wind turbines have been used to generate electricity. Today, wind farms using turbines are used to generate electricity on a larger scale and are a cleaner alternative to engines and generators using fossil fuels. A windmill/wind turbine is made up of the simple machines, wheel and axle. Attached to the rotating shaft are panels or sails that are angled to catch the wind and turn the shaft. As the shaft turns, it can be used to turn gears and grinding stones, move a pump rod up and down to pump water, or spin a generator to turn kinetic energy into electrical energy.

Project Goal: Build a pinwheel (wind mill) that can lift a cup with a payload. Adapt and adjust the design to build a better wind turbine.

What to Do:

1. Use the attached pinwheel pattern or cut out a 6.5” by 6.5” square.
2. Mark the center of your square and cut from the corners diagonally towards the center of the square, stopping about 1.5” from the center point. If using the pattern, follow the guide lines.
3. Use a sharp pencil or a push pin to make a hole in the center and at the end of every other one of your 8 corners. The hole should be large enough for the pipe cleaner or skewer to fit through.
4. Push the pipe cleaner through the center of your square and then bend (don’t fold) each of the corners onto the pipe cleaner. Try to avoid bending or kinking the wire of the pipe cleaner. Leave about 2 inches of the pipe cleaner sticking out of the front of the windmill and bend it to form a loop.
5. Secure the front and back of the pinwheel with tape to keep the pinwheel together. There should be about an inch of space between the front and back of the pinwheel.



6. Tape the straw to the edge of a table.
7. Thread the long end of the pipe cleaner through the straw.
8. Take the small cup and cut two holes in opposite sides and tie a small piece of string between the two holes, creating a sort of bucket handle.
9. Secure one end of your string to the loop of pipe cleaner.
10. Now blow on your pinwheel with your mouth, then with a blow dryer or fan. Watch the windmill lift the cup. Experiment with different wind speeds, using high and low settings.
11. Try different "payloads" such as pennies, small plastic to see how many you can lift—but be careful---they can fly out! Consider using a lid or plastic wrap to restrain them.

Reflect:

1. How could changing the design of the turbine effect how well it functions?
2. Could wind speed and direction impact the usefulness of a wind turbine or wind mill?
3. What would engineers need to consider before building a windmill or windfarm?

Apply:

1. Why is it important to have alternative uses of energy available?
2. How would a wind mill (water) or a wind turn bine (electricity) add value to your community?
3. What would you need to consider before putting either of these into your community?

Going Further:

Try changing the design of your turbine and finding other tasks that could be accomplished using wind energy. Using common household items such as straws, pencils, corks, push pins, paper clips, paper or foam plates, cards stock or other items to create your own unique designs. Try designs with more blades, fewer blades, or different shapes and patterns of wind turbines. For another fun wind lesson, go to https://4-h.org/parents/4-h-stem-challenge/wired-for-wind/

Go to https://4-h.org/parents/curriculum/wind-energy/ for the National 4-H Power of Wind curriculum.

Notes for Parents or Helpers:

You can also use a wooden skewer or unsharpened pencil instead of a pipe cleaner. You will need to secure these with tape. For older children, give them the materials and allow them to build design and build their own turbine. Covering the "bucket" with a lid or tape will prevent losing their payload, but may throw the "bucket" off balance. Allow children to experiment and adjust their designs.

More information on how wind turbines work can be found at
https://www.energy.gov/eere/wind/how-do-wind-turbines-work
https://www.scientificamerican.com/article/strong-wind-science-the-power-of-a-pinwheel/

This activity was adapted from
https://4-h.org/wp-content/uploads/2018/05/4H-STEM-Lab-Wind-to-Lift-a-Load-Activity.pdf

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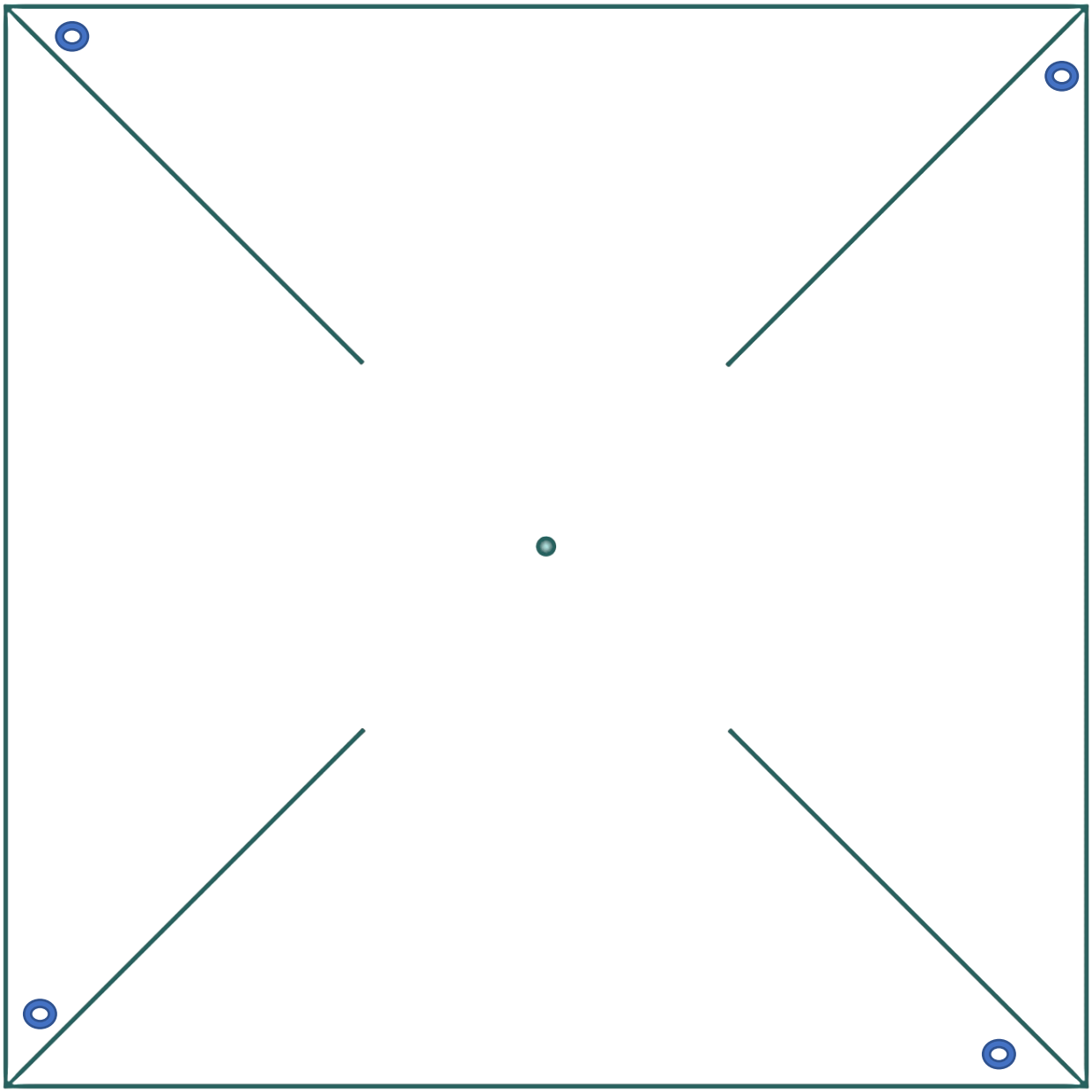

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