PRAIRIE STEM

60 Minutes

Virtual STEAM

Science, Engineering, and Math

Wind Turbine Challenge

Goal: I can create a working wind turbine

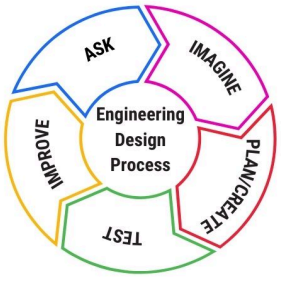
Science Indicator: SC.4.4.2.D Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
Engineering Indicator: TEL-2J Demonstrate how tools and machines extend human capabilities, such as aiding, lifting, carrying, fastening, separating, and computing.
Math Indicator: MA 4.3.3.b Identify and use the appropriate tools, operations, and units of measurement, both customary and metric, to solve real-world problems involving time, length, weight, mass, capacity, and volume.

Materials:

- 1 - File folder
- 1 - Skewer
- 1 - 5X7 inch Cardboard
- 2 - Straight Straws
- 1 - Paperclip (Small)
- 30 - Address Labels / Tape
- 1 - 8-inch Cardboard Tube
- 1 - 3 oz Dixie Cup
- 3 - Marbles
- 2 Ft. String
- 1 - 6-inch Metric Ruler

Not Included:

- Scissors
- Fan



Instructions:

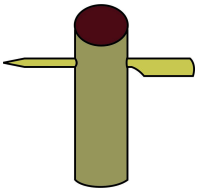
1. Watch YouTube Video for background knowledge: https://www.youtube.com/watch?v=_hPNm8p7K8Y
2. The video you just saw shows us how tools and machines help us do difficult tasks, like lifting heavy objects.
3. **ASK:** Can you engineer a wind turbine today?
   This type of wind turbine is used to create electricity using wind power.
4. In order to make electricity from wind, we use large windmills called wind turbines. The reason for this name is they use turbine generators to generate the electricity. Wind turbines work

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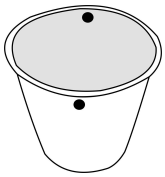
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the opposite of electrical fans. Instead of using electrical energy to make wind, a wind turbine uses wind to make electricity. The wind turns the blades, which turn a shaft, that connects to a generator, and produces electricity.

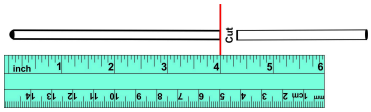
5. **IMAGINE:** On the back of your cover sheet, design what your wind turbine will look like.
6. **PLAN/DESIGN:** Using your skewer, poke a hole straight through your cardboard tube and out the opposite side. The cardboard tube is your wind turbine's **Tower**.



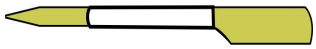
7. Using the same skewer, poke a hole straight through your Dixie Cup and out the opposite side.



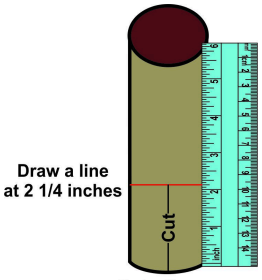
8. Measure and cut one straw at 4 inches.



9. Put the skewer through the 4-inch piece of straw.



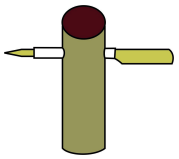
10. Measure and draw a line on your cardboard tube (**Tower**) at the 2 1/4-inches all the way around it.



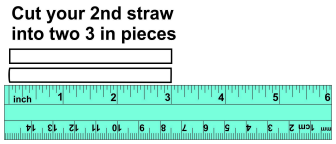
11. Cut from the bottom of your cardboard tube (**Tower**) up to your line.
12. On the opposite side (on the backside) make a cut from the bottom up to that same line.



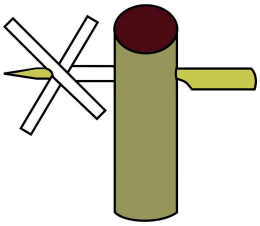
13. Now turn your tube slightly and add two more cuts so you have 2 sets of parallel cuts.
14. Fold sides of the cuts back to make 4 sturdy legs.
15. Push your skewer and straw through the holes in your cardboard tube.



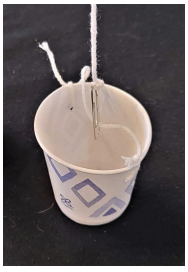
16. Using your 2nd straw, measure and cut two 3-inch pieces. These 3-inch pieces are the **Blades** of your wind turbine.



17. Push the point of the skewer through the center of each straw to create the **Blades** for your turbine.



18. Cut a piece off your string 5-inches long. Feed one end of the string through the small opening in the paper clip.
19. Tie this piece of string through both holes in



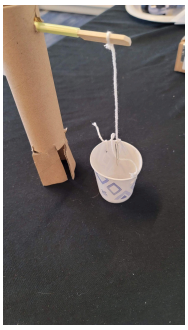
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60 Minutes

your Dixie Cup, tying 2 knots, one on each end.

20. Use the remaining piece of string to tie a knot tightly around the blade of the skewer.
21. Thread the other end of the string through the larger hole in the paper clip and keep pulling it through until your string is straight with the Dixie Cup sitting on the table. Tie a knot using the extra length of the string so the cup is still sitting on the table. Cut off the excess string.



Put your marbles in your cup, use the straw **blades** to turn to raise the cup to the top.



22. You can test it using a fan pointed at your blades to test if your wind turbine is successful.
23. **IMPROVE:** If unsuccessful, tweak your turbine and test again.
24. Test it outside in the wind. You can see how the wind turbine converts energy from one form to another. It converts the power of the wind into motion or electricity (if electrical connections were added).
25. Document the challenge using video, photos, drawings, etc.
26. Have fun!

Lesson Extension:

- Do the propellers of your wind turbine turn if you turn a fan on in front of it?
- Can you think of something you can use your wind turbine for?
- Do the propellers of your wind turbine turn in the house without wind?
- Energy 101: Wind Power https://www.youtube.com/watch?v=niZ_cvu9Fts

Learning Connection:

- **HardWork/Perseverance/ Resilience** – When we continue to do something despite difficulties that may arise and we don't give up. This lesson is a great example of how persevering pays off in the end with a working example of a wind turbine!

Book Extension:

Wind Power: Sailboats, Windmills, and Wind Turbines by Matt Ziem