Gone With the Wind

4-H STEM

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OVERVIEW

In recent years, the magnanimous push to go green and provide more efficient energy sources to consumers has become a mainstream topic. Wind powered turbines serve in the effective process of creating green, renewable energy sources that drastically reduce the carbon footprint of our society. But, how do wind turbines work?

Wind turbines, like windmills, are mounted on a tower to capture the most energy. At a height of 100 feet (33 meters) to 400 feet (133 meters), they can take advantage of the faster and less turbulent wind. Turbines catch the wind's energy with their propeller-like blades.

According to the Office of Energy Efficiency & Renewable Energy, "A wind turbine turns wind energy into electricity using the aerodynamic force from the rotor blades, which work like an airplane wing or helicopter rotor blade. When wind flows across the blade, the air pressure on one side of the blade decreases. The difference in air pressure across the two sides of the blade creates both lift and drag. The force of the lift is stronger than the drag and this causes the rotor to spin. The rotor connects to the generator, either directly (if it's a direct drive turbine) or through a shaft and a series of gears (a gearbox) that speed up the rotation and allow for a physically smaller generator. This translation of aerodynamic force to rotation of a generator creates electricity."

Sciencing states that windmills convert wind energy directly into mechanical energy for such tasks as milling grain–the source of the term–or pumping water, which is usually the purpose of windmills you see on farms.The spinning vanes of a windmill turn a camshaft, which is connected by gears and rods to the machinery that does the work. All power is directed into the work. A wind turbine converts wind energy into electricity, which can then be used to power electrical equipment, stored in batteries or transmitted over power lines. A wind turbine has essentially the same parts as a simple electric motor, but it works in reverse: A motor uses electrical current to produce motion; a wind turbine uses motion to create electrical current.

These fascinating technological infrastructures are imperative to the green energy movement. The movement of these propeller-like blades is what creates the energy needed to satisfy our electronic needs each and every day.

Location and proximity of the wind farms where turbines are constructed have a major impact on the amount of energy created. The more wind a location, the more movement of the propellor- like blades. As a result, the faster the speed of the wind, the more likely that a greater amount of energy will be created. We use a device called an anemometer to measure wind speed and hypothesize about potential amounts of energy to be created.

ACTIVITY

Teach Engineering Definitions

Wind Vane/ Weather Vane- spins in the wind and shows the direction that wind comes from

Anemometer- measure wind speed and can be used to decipher if an arid space has enough ventilation (ie- tight spaces such as mines)

MATERIALS NEEDED

- 4 plastic drinking straws
- 4 small paper cups
- stopwatch
- tape
- straight push pin
- pencil with new eraser
- felt tip marker

STEPS

In today's activity, you will create an anemometer to approximate wind speed.

Step 1: Overlay the corners of your straws so that they lay together and form a cross. Place tape over and around this connection joint where the straws cross.

Step 2: Color or mark one of your cups with a felt-tip marker. After your anemometer has been created, you will measure wind speed by counting the rotations per minute that the colored cup completes in sixty seconds.

Step 3: Tape the small paper cups to the ends of the four-way cross straws. Make sure that the opening of the cups are all facing in the same direction. This step is necessary to ensure that airflow will be able to move and displace the anemometer into motion.

Step 4: Use your straight push pin to puncture a hole into the intersection of the four straws. Do not remove the straight push pin.

Step 5: Insert the straight push pin in the top of the new pencil's eraser.

Step 6: Now that your anemometer's design has been completed, let's test your project. Take your anemometer outside or place in the direct motion of a fan's air current. For sixty seconds, count the amount of rotations that your marked or colored cup completes. Ten turns per minute equates to one mile per hour. Two turns per minute would equate to two miles per hour, etc.