Build a wind turbine

It's competition time! In groups design and build what you think is the best wind turbine blade design – the turbine that turns in the wind the fastest (without breaking!) is the winner!

Get this stuff:

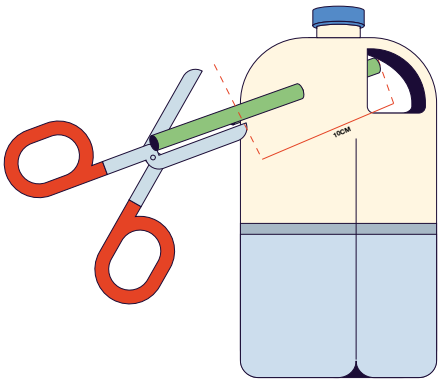
- Desktop fan or hairdryer
- Scissors
- Milk carton or plastic bottle
- Sand or water
- Straws
- Skewers
- Plastic or paper cups
- Plasticine
- String
- Pens and pencils
- Stopwatch
- Cardboard, craft paper, tape or anything that can be used to make a turbine blade!

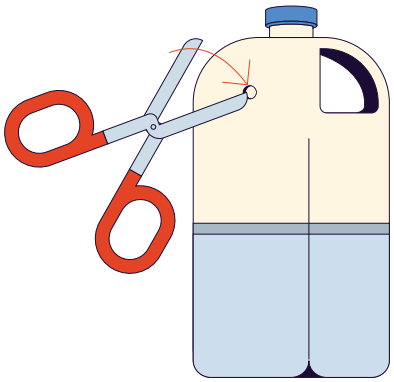
Safety

- Scissors have sharp points and blades. Make sure those using scissors are comfortable and responsible with their use.
- Desktop fans or hairdryers are electrical equipment and should be operated under supervision.

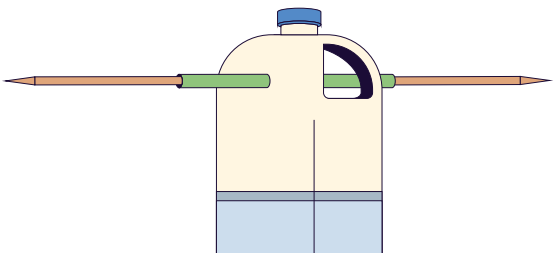
Do these things:

1. Fill roughly a quarter of the bottle with sand or water. This will help weigh it down in later steps.



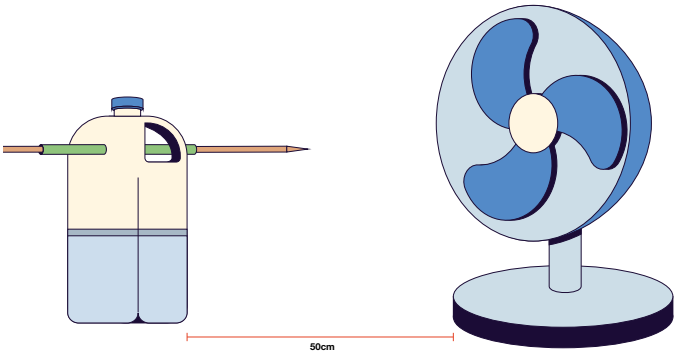


2. Push/poke a hole through the milk bottle (both sides) near the top. Make the hole the diameter of the straw.

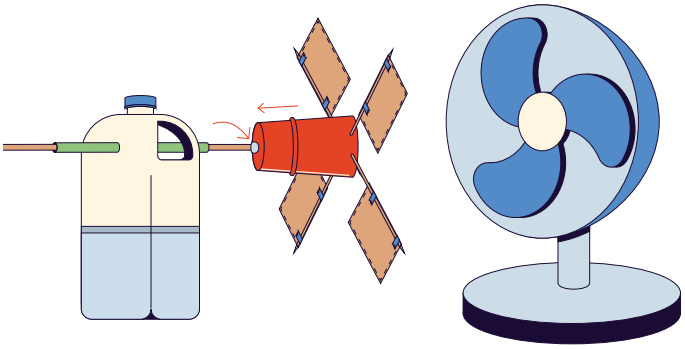


3. Push the straw through both of the small holes you cut into the bottle. Trim the ends of the straw so just a centimeter or two sticks out of each side.

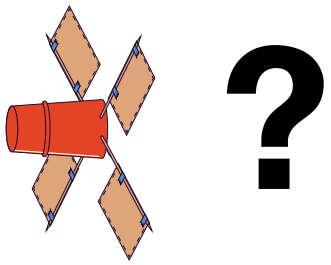
4. Insert the skewer into the straw. This is the base of the turbine ready to have blades mounted.



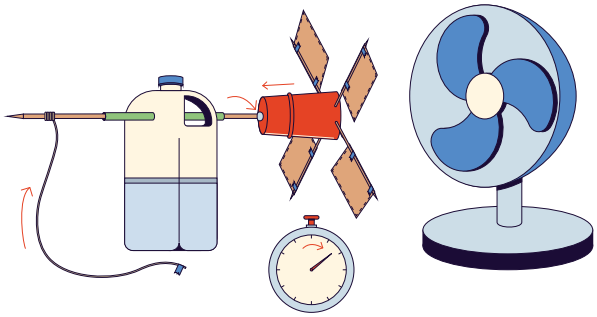
5. Setup the desktop fan, or hairdryer approximately 50cm from the turbine base.



7. Mount your turbine on the skewer. You might need to use plasticine to secure it in place.



6. Design a structure that will turn when air from the fan or hair dryer pushes on it. Consider what it will be made out of. How might it connect to the skewer? What materials will it be made out of? How will it catch the air?



8. Attach a marked piece of string to the skewer and use the stopwatch to time how long it takes to wind that length of string around the skewer.

What's going on?

In simple terms:

Similar to how air passing over an airplane's wing creates a 'push' we call lift, air passing over a turbine's blade also creates a force. When mounted to the base, the turbine blades turn when wind passes over them, redirecting the kinetic energy in the wind into a rotating movement in the turbine. The design of the wind turbine blades has a direct relationship to how efficient the wind turbine will be in converting wind into energy.

In more complicated terms:

Turbine blade design is driven by the aerodynamic performance required to efficiently extract energy from the wind, and by the strength required to resist the forces applied to the blade by the wind.

The magnitude and distribution of the force of wind is the primary focus of wind-turbine aerodynamics. When the wind hits a turbine blade, a pocket of low-pressure air forms on one side of the blade. The low-pressure air pocket then pulls the blade toward it – lift, or the force perpendicular to the air stream. The force of the lift is much stronger than the wind's force against the front side of the blade – drag, or the force parallel to the air stream. This combination of lift and drag applied to the blades causes the rotor to spin like a propeller.

How do we use this?

Making a turbine out of strong, lightweight materials and designing them into different shapes help them to turn efficiently under a range of conditions. Wind turbines need to be large, tall, and to turn easily to move powerful magnets that create electricity. Many are formed out of lightweight carbon composites for strength and to make them low weight