TRY FIVE +

WORKSHOP 4

WIND TURBINE

ACTIVITY 1: How to Make a Wind Turbine?

1. ELECTROMAGNETISM:

Magnetism and electricity are like two sides of the same coin. Electromagnetism is the type of magnetism produced by an electric current. This phenomenon was discovered by a Danish scientist named Hans Oersted in 1819.

When an electric current passes through a metal, the flow of electrons creates a magnetic field. The magnetic force starts when the electricity flows, and stops if the electric current is disconnected. This kind of magnetism is called electromagnetism, and it is very useful for making magnets that can be switched on and off.

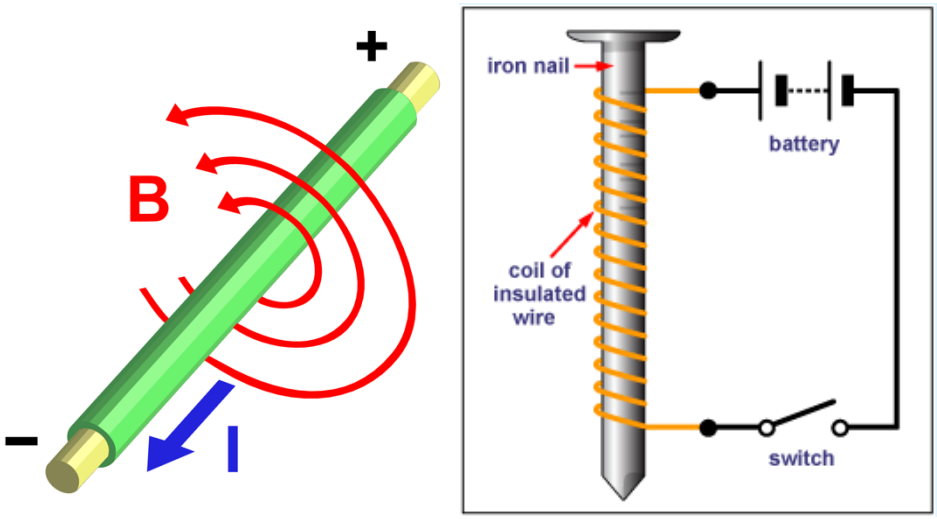


Figure 1: Magnetic field generated around the cable where the electrons flow. Credit: Wikipedia Commons. Traced by Users: Stannered, Rajiv1840478, 2022.

Likewise, a magnet moving over a conductive metal causes electrons to flow. When this flow of electrons is big enough, it can also be used to generate electricity to power electronic devices such as LEDs. This is the principle behind the work of dynamos, inductors, and some electric motors.

2. HARNESSING THE ENERGY OF THE WIND:

Having to manually move a magnet over one or more metal coils to generate electricity is quite tiresome (because it uses your body's own energy!). Scientists, engineers, and inventors continuously work to design devices, like wind turbines, that can take kinetic energy from natural sources and transform it into electricity. Wind turbines produce electricity when the wind turns the blades or propellers in the turbine. The more turns, the more energy, so the design of the blades can affect how much energy you get!

3. LET'S BUILD OUR WIND TURBINE PROTOTYPE!

Now that you know a bit more about turbines and energy generation, would you be able to make your own turbine using the provided materials?

3.1. WHAT YOU WILL NEED!

- 1x wood base
- 1x DC motor
- 2x spring clips
- 2x crocodile cables
- 1x LED
- 1x hard paper rectangle and tape
- 4x toothpicks
- 1x multi-meter
- 1x plastic blade
- 1x foam centre

SAFETY NOTES!

1) Do not attempt to do electronics on your own without the supervision of a knowledgeable adult.

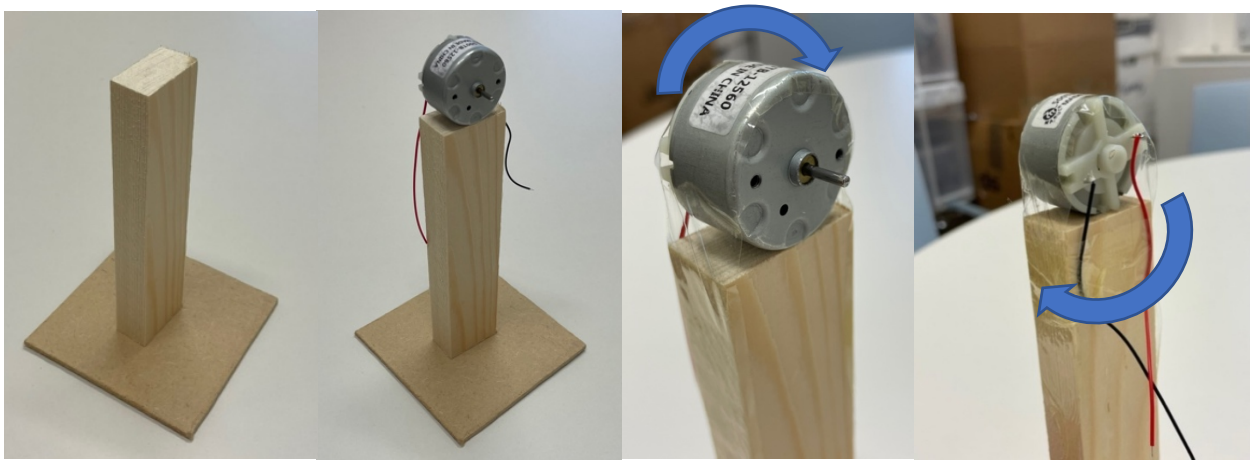
2) We will be using wood with sharp ends, do not mess around with it as you can hurt yourself and/or others.

3) If you are not sure about how to do things, ask the responsible person in the room!

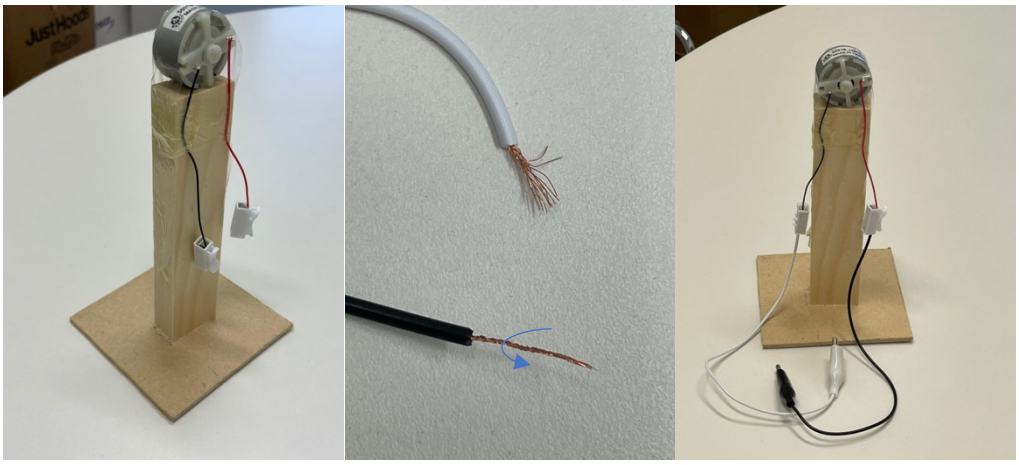
3.2. BUILDING STEPS!

A) MAKING THE TURBINE BODY

1. Secure the Motor.
    - Place the motor on the base and fix it with tape. Make sure the motor doesn't move, and no tape is covering the spindle.
2. Secure the Motor Cables.
    - Use tape to attach the top part of the motor's cables to the turbine shaft. This reduces the movement during experiment and prevents them from breaking.

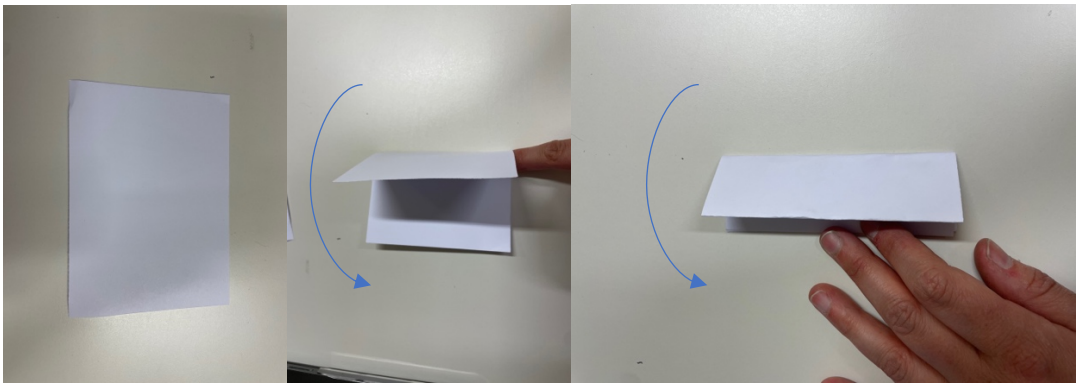


3. Connect the Cables.
    - Use spring connectors to attach each motor cable to the crocodile clips.
    - Note: Ensure only the metal parts are connected to allow electricity to flow.
    - If the cable ends are frayed, twist them into a neat spiral with your fingers for easier connection.

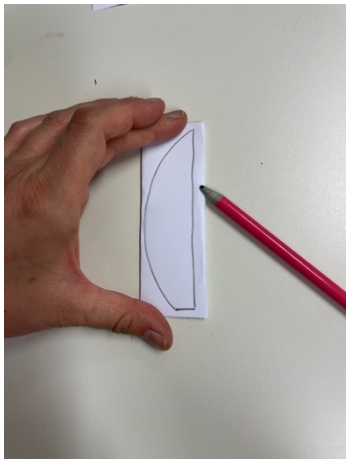


B) MAKING THE TURBINE BLADES

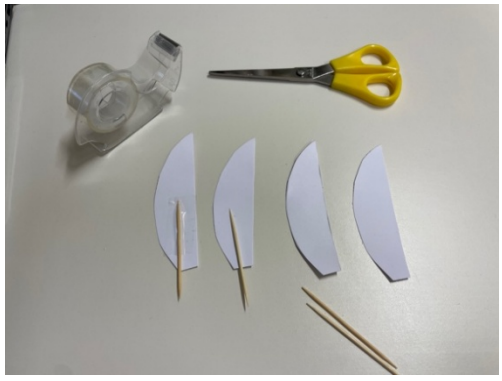
1. Turbines work better when their **blades have the same shape**. Fold the piece of paper in half, and then in half again.



2. Draw the design of your blade and cut it. You should now have 4 identical blades!



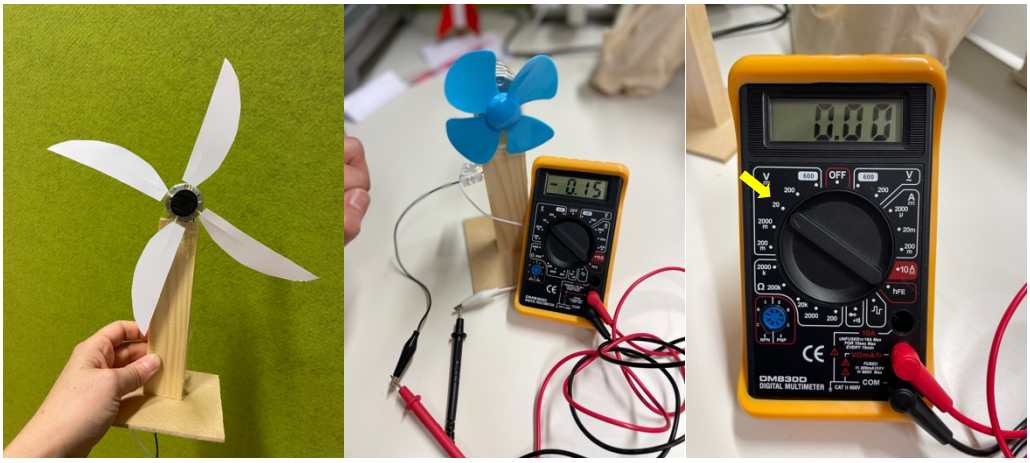
3. Attach the blades to the toothpicks using tape, leaving at least 2cm of toothpick uncovered. Don't use too much tape, or your blades will become heavier.



4. Attach the blades to the foam cylinder and attach the cylinder to the motor by making a small hole in the very centre. Make sure the blades are able to spin and that they are hitting no obstacles!

C) TESTING YOUR PROPELLER

1. Connect your wind turbine to the multi-meter. The multi-meter measures the voltage generated by your turbine when the blade spins. Set the dial in the multi-meter to V (for voltage) and 20. You should now see 0.00 in the screen. What happens if you make your blade spin?

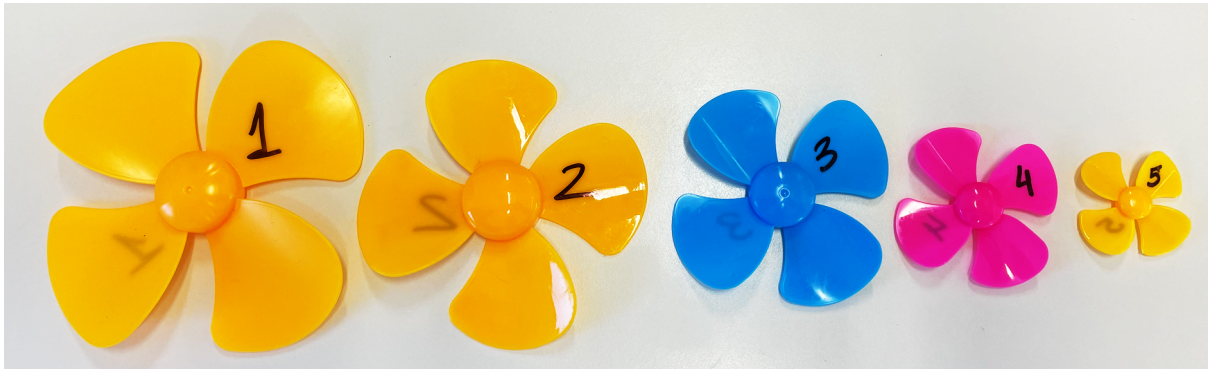


2. If the values in the screen do not change when you spin, re-reck your connections! You may have accidentally pinched the insulating sleeve in a cable and prevented electricity from flowing freely!

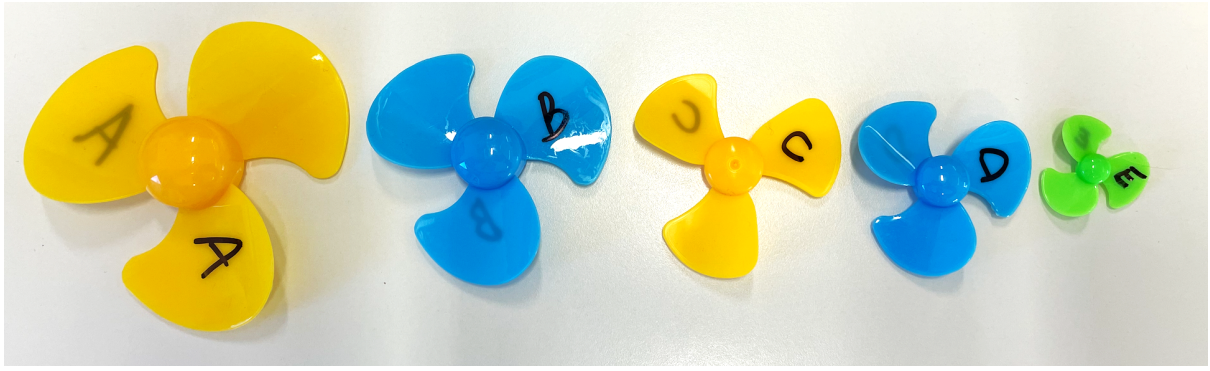
Let's experiment with our blades! Can you make them better?

PROPELLER TYPES

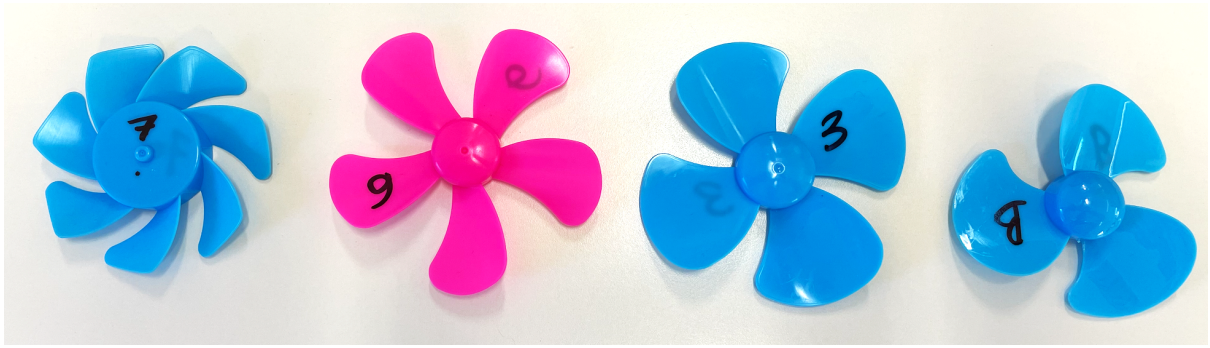
4-Blade Propellers of different sizes



3-Blade Propellers of different sizes



Similar size propellers with different number of blades



TRY FIVE +

ACTIVITY 2: TURBINE RESEARCH.

DO IT YOURSELF!

1) Draw your blade design.
2) Measure the voltage generated by your blades.
3) Make improvements and write your observations!

PROPELLER DRAWING	WHAT IS DIFFERENT ABOUT THIS DESIGN/ WHAT CHANGES DID YOU MAKE?	VOLTAGE GENERATED	OBSERVATIONS
	This is my first try.		

→ ADVANCED TURBINE RESEARCH!

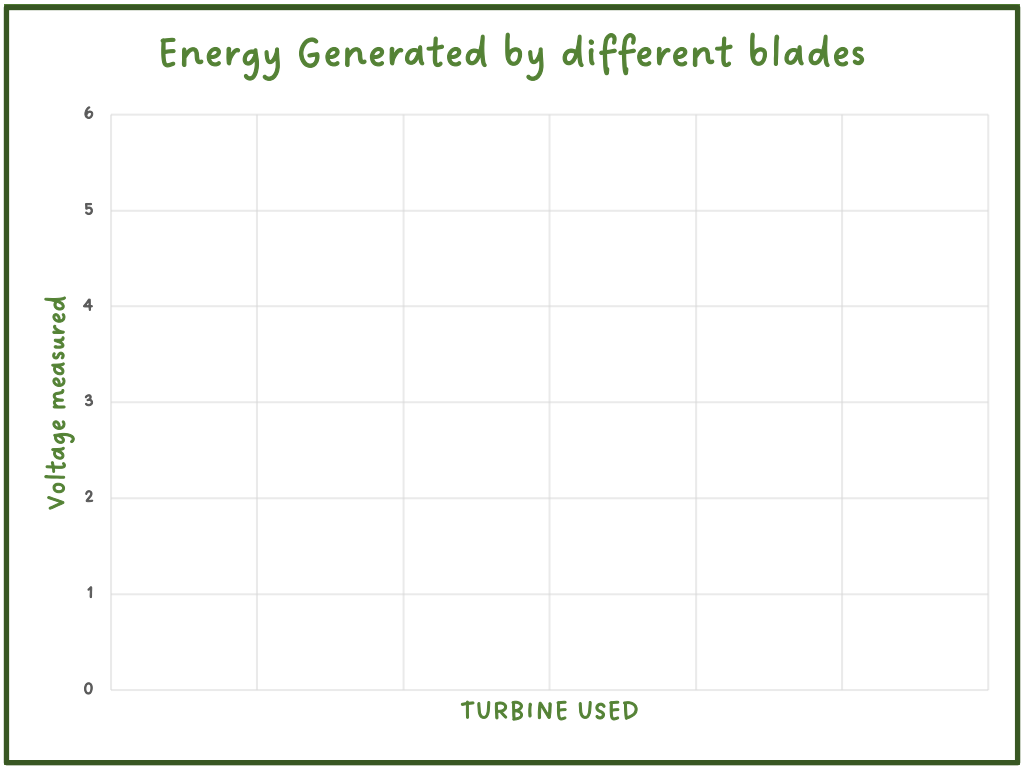
Have a look at professionally designed blades. You have a series of propellers that have different sizes, weights, and number of blades. Can you compare them to see what works best?

Measure the voltage generated and write down your observations. What do you think makes a better turbine, bigger blades? More blades?

PROPELLER CODE	NUMBER OF BLADES	DIAMETER	VOLTAGE GENERATED	OBSERVATIONS

TRY FIVE +

You can use these graphs to help you visualise your results!



Observations:

Is the turbine you are testing bigger/smaller than the one before? Does it have more/less blades? Does it work better at producing electricity or worse (less volts)? Write your notes here!

DRAW YOUR FINAL DESIGN!

How much voltage were you able to generate with the turbine you made?