



Learn about wind energy by designing your very own Mini Wind Turbine!

> Choose how you would like to complete this activity. Download documents & videos at teachergeek.com/miniwind

Go Guide Start here! Build your Mini Wind Turbine, evolve your design, and begin the Voltage Challenge!

You Are Here

-Blade Design Lab (Ages 8+)

Optional Challenges -Wind Speed Challenge*

-Wind Direction Challenge* -Environmental Challenge*

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WHOOOSH!

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Supplies

TURBINE PARTS

These are the parts you need to build one Mini Wind Turbine, plus some extras, so you can make your own unique designs.

	/ QΤΥ	PICTURE
Hole Plate SKU 1821-32	1	
Blocks SKU 1821-34	2	
Nuts # 10 Hex SKU 1821-25	1	\bigcirc
Screws 25 mm (1 in) SKU 1821-22	1	
Mini Hub Screw SKU 1821-66	1	E DUDUDUS
Mini Hub Cover SKU 1821-66	1	Maker Cart Users:
Mini Hub Base SKU 1821-66	1	Red Hubs, not the Green Hubs.
Motor 1.5V – 3V SKU 1821-75	1	
Motor Mount Small 1.5V – 3V SKU 1821-69	1	
Chipboard 22 cm x 5 cm (8.5 in x 2 in) SKU 1823-48	3	
Project Sticks various sizes SKU 1821-17 & 1821-18	12	<u>Stick Sizes</u> 6x 25 cm (10 in) 6x 10 cm (4 in)
Dowels various sizes SKU 1821-20	3	Dowel Sizes 1x 30 cm (12 in) 1x 15 cm (6 in) 1x 5 cm (2 in)

Have a Maker Cart? Use Multi-Cutters to 🛛 🚽

cut your own dowels.

MATERIALS YOU SUPPLY

- Phillips Screwdriver
- Fan
- Digital Multimeter (to measure voltage generated)
- 4x Alligator Clip Leads (optional – for connecting Multimeter)
- 2.7 Ω Resistor
 (optional to smooth voltage readings)
- Tape
- Recycling Materials (to use as turbine blades)





Get everything you need to test your turbine in one convenient kit!

SKU 1823-68







Connect your Leads

to the V and COM

Terminals.

Testing

How well does your turbine work? Hook up a Multi-Meter to find out!

Set up your meter.

- 888

Set your dial

to 200mV DC.

You are going to hook up a Multi-Meter to your turbine to measure the voltage it generates – the faster your blades spin, the greater the voltage will be. More volts means more power!

14 Connect your meter.

You will **connect** your **meter** to the **terminals** of the motor/generator.

There are two ways to connect your meter. Option 1 is a little bit easier to set up, but Option 2 fluctuates less when testing.





A The **Turbine Blades** convert Wind Energy to Mechanical Energy.



- Wind Energy is really
- Kinetic Energy it's the
- energy of the moving air molecules.



Mechanical Energy is the Kinetic and Potential Energy of the spinning turbine blades.

B The Generator converts Mechanical Energy into Electrical Energy.



When the **Generator** (motor) spins, the wire coils and magnets inside create electricity.



Electrical Energy is the energy of electricity (electrons traveling through the wires).

C The **Light Bulb** uses the Electrical Energy, so it's called the Load.

Loads are anything that uses electrical energy, like your TV, vacuum cleaner, and phone.



Only one of the turbine testing options, from Page 4, has a load. Which one? What's the load?

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Voltage Challenge

The design that generates the greatest voltage wins!

Constraints:

(rules and limits for your design)

Setup:



Materials:

You may only use the supplies listed on Page 1.



You can use as many recycling bin materials as you want!

You must design your own blades.



You may not use pre-fabricated blades (e.g. from a pinwheel).

Blades must not be dangerous (e.g. metal, sharp edges, etc.).





Additional Challenges

You finished the Voltage Challenge and want more? Try one of these! Use the same setup and material constraints as the Voltage Challenge.

Wind Speed Challenge:

Each competitor does **three trials**, back-to-back, with different fan speeds (**Low, Medium, High**). There is a **1 minute adjustment period** between trials to swap/adjust the blades for each speed.

The turbine that generates the greatest voltage wins!

Wind Direction Challenge:

An opponent places your turbine 60 cm (24 in) from the fan, turned whichever way they want. Your turbine needs to use wind power to rotate and turn into the wind.

The turbine that generates the greatest voltage wins!

Weather vanes turn to face the wind – can you make your turbine do it, too?



Environmental Challenge:

Wind turbines are criticised for looking ugly and killing birds. **Modify your turbine to look nice in nature and have safety features to protect birds from the blades.**



Design Tips:



your turbine in place.

Add a vane (blade) to the back of your turbine to make it turn to face the wind.

Make your block pivot (turn) on the hole plate.

 Dowel pulled up from hole plate.

Screw & nut slightly loose.

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Tuning Your Turbine

Want to generate more voltage? You need to spin the generator fast!

Test it out!

Try **spinning the shaft at different speeds** in your fingers, and check the reading on the meter.



What makes it spin faster?



Blade angle is the most important variable, and it's also the easiest to change! **Try shallow and deep angles** – **what works best?**





Each blade acts like a lever turning your generator. What works better for speed – long or short blades/levers?







Once you figure out how blade length and angle affect your turbine, **try changing the shape and number of blades.**



Full size wind turbines use **gears** to spin the generator quickly, even though the blades move slowly. Gears trade **torque** for speed, like levers.



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Inspiration

Vertical Axis Turbines work no matter what direction the wind comes from!

Use a **shroud** to **increase** the speed of the **wind** hitting your blades.





Make unique **3D shapes** by cutting up plastic bottles and other **recyclable materials**.

Make a fan by using 1 or 2 AA batteries to power your motor.





There is no perfect design. The design process never ends!