

# Tower Assembly & Testing Set Up

## KidWind Challenge Teacher Instructions



### Tower Assembly

1. Using the KidWind kit, assemble the tower and base with three supports.
2. Wrap a piece of duct tape around the outside of the motor. Tape should be about 1/2" wide and 18" long. This will help the motor fit securely into the PVC coupler.
4. Use the PVC Tee fitting, 3" PVD pipe, PVC coupler. Arrange the pieces as they look in Image #1. Push them together to form a solid piece like Image #2. On a large wind turbine this is called a nacelle. It holds the generator, gear boxes, and other equipment.

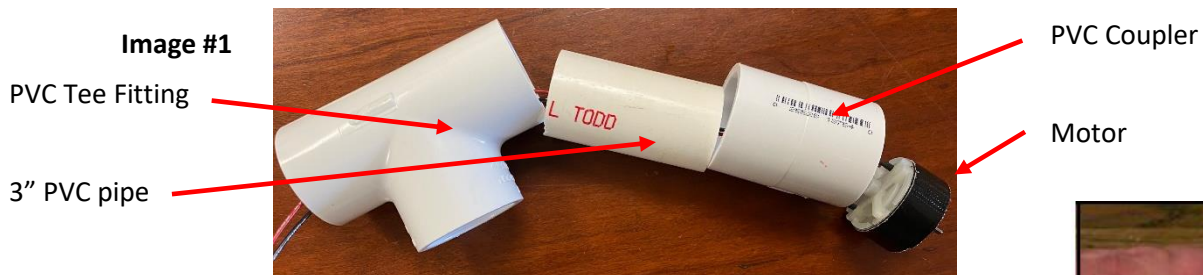
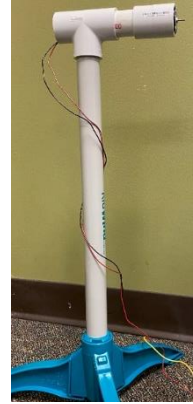


Image #2

5. Insert the wires attached to the DC motor through the nacelle. They should come out of the PVC Tee fitting. (Image #2)
6. Insert the motor into the PVC coupler. It should be straight and fit VERY snugly. If it is too loose or too tight adjust by wrapping or unwrapping duct tape around the outside. Since the motor is pushed on frequently by students, it must be TIGHT! You can glue this in to make it secure. If the motor looks cockeyed, straighten it out as it will cause your hub and blades to wobble while spinning.



7. Attach the nacelle to the top of the tower.
8. Attach the finished blades, by loosening the top screw of the hub. Insert the dowels with the completed blades. Adjust the pitch, then tighten. Be sure blades are secure to prevent them from flying off when testing.
9. Press the hub onto the driveshaft. It should fit very snugly.
10. Wrap the motor wires around the tower and secure to the base with electrical or duct tape. You can also drill a hole in the base of the tower before assembly. Snake the motor wires down the tower and through the hole in the PVC at the base of the wind turbine.



## Safety & Testing Turbine Blades

- It is important to wear safety goggles when constructing and testing blades.
- **NEVER** make blades using metal or any sharp-edged material as they could cause injury while spinning fast during testing.
- Safely set up your testing area like the picture. It is important to clear this area of debris and materials.
- Make sure the center of the fan matches up with the center of the wind turbine. You may need to raise your fan with some books or a container.
- Using the alligator clips, attach your multimeter with the resistor to your motor using the attached instructions.



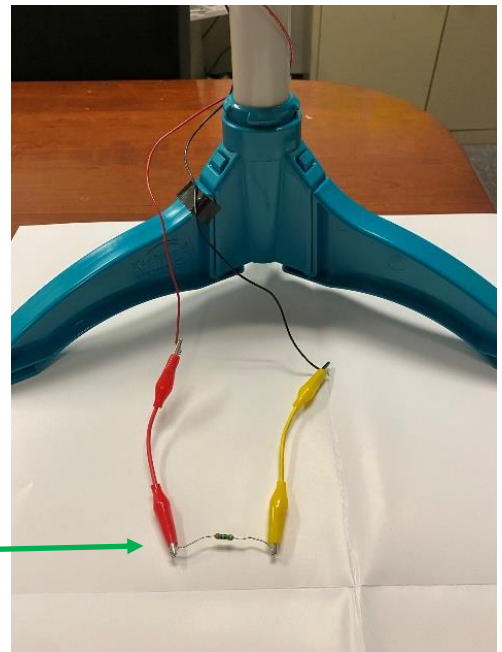
## How to Use a Multimeter to Measure Voltage on the KidWind Turbine

Wind turbines produce electricity. The best way to understand this is to connect your turbine up to a load or a multimeter. Using this tool, you can quantify the voltage or current. You will only need the voltage information on your data sheet to calculate the power that your turbine produces.

### Steps to using the multimeter.

1. Connect the generator to the resistor. *(Image 1)*

- Attach an alligator clip to each end of the generator wires. Be sure to clip to the bare wires and not the insulation.
- Attach the other end of the alligator clip to the 30-ohm resistor as pictured.



2. Connect the multimeter. You will use it to measure voltage.

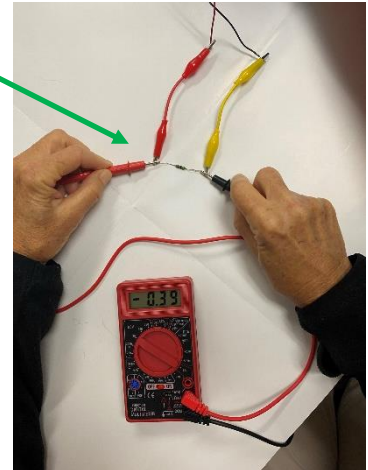
Voltage is related to how fast the DC generator is spinning. The faster the generator spins, the higher the voltage. *(Image 2)*

- Insert the black probe in the common jack. It is marked COM.
- Plug the red plug into the jack labeled for DC voltage, V $\Omega$  or V $-$ .
- Turn on the multimeter.
- Dial to DCV to mean direct current voltage. Set the number to 2000m. The voltage range at this setting is .2 volts to 2 volts.
- If the 2000m setting is used, students will need to convert their reading to volts before recording the reading on their datasheet.
- Convert millivolts to volts by dividing by 1,000. Example: If your reading is 540 at the 2000m setting, then  $540/1000 = .54$  volts.
- Typical blades are in the .4 volt - .8 volt range. A set of well-designed blades may measure 1-2 volts.



3. Connect the multimeter to the generator. (*Image 3*)

- Place your turbine in front of the fan and let it spin. It is normal for the voltage reaching to fluctuate.
- With the black/red jack in each hand, touch or connect the probes to each end of the alligator clip/resistor connection point. You are measuring voltage ACROSS the resistor.
- Read the measurement displayed on the multimeter. Students record voltage on their datasheet. They do not need to note if it is a positive or negative number.
- Record the highest reading.



4. No voltage measurement? Set the multimeter to a higher voltage range.

- Turn the dial to 20. This setting will read voltage in the range of 2 volts to 20 volts.
- If the 20v setting is used, students will NOT need to convert their reading to volts before recording the reading on their datasheet. The reading on the multimeter will be in volts.



Still not certain if you understand the set-up?

[Watch the Tower Assembly and Testing Set-Up video.](#)