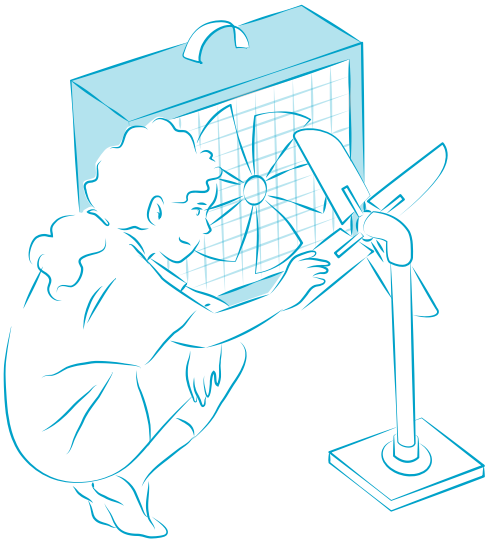
RULES: WIND TURBINE DESIGN CHALLENGE



Using your knowledge of how wind energy works, build a small turbine to produce as much power as possible! Think about the best construction techniques and the most innovative design to make it operate. Entires will be judged based on performance as well as creativity, quality, and demonstrated knowledge.

What materials should I use?

The great thing about the Wind Turbine Design Challenge is that it is wide open and you can participate from anywhere in the world. You can use REcharge Labs gear, KidWind gear, our competitors gear, or stuff you hack together from around your house or classroom. While most of the materials you need to build a small wind turbine can be found locally, the REcharge Labs Store and our partners at KidWind offer a variety of kits and materials that can help you get started.

What are the rules for building and testing my turbine?

Wind Source

Power must be generated by wind from a fan or by the ambient wind outside. How close you put your turbine to the fan, or how windy of a day you test on, is up to you. If you use a fan, our Fan Speed Cheat Sheet will help you estimate wind speed. If you're outdoors, it will be harder to measure wind speed unless you use an anemometer. The stronger the wind, the more power you'll produce!

Measurement Units

Use metric units when collecting data. Measure blade diameter in centimeters (cm) and wind speed in meters/second (m/s). There are handy converters on Google.

Turbine Size & Orientation

The maximum rotor (blade) diameter allowed is 200 cm. The height of the tower is up to you. You can make either a vertical or horizontal axis turbine.

Power Generators

We require that you provide us with details about your generator so that we can judge your turbine properly. Three categories of generators are legal, and all types of generators will be judged by the same criteria. All generator types will compete against each other, but we will weigh power output differently, recognizing that some generators produce more power than others.

- KidWind Generator: Turbines are built with either a KidWind Wind Turbine Generator or the Hi-Torque Generator.
- Other DC Generator: Turbines use a DC generator that you found in your house, your classroom, or purchased from another store - not KidWind.
- AC Generator: Turbines iuse an AC generator that you built yourself or purchased from a store.

Budget

There are no budgetary restrictions for the Wind Turbine Design Challenge, but keep in mind that part of our judging process is the economical use of resources. Likewise, turbines earn points for creativity, so homemade ones are more likely to win! Please use materials responsibly.

Pre-Manufactured and 3D Printed Parts

Pre-manufactured gears and drive train components are allowed. However, you cannot use premade turbine blades or airfoils. 3D printed parts are allowed if you've designed them. We may ask to see your design files.

Safety!

Plexiglas, metal, and other heavy or dangerous blades are highly discouraged as these can be precarious when spinning at high speeds. The team coach must approve the security of any questionable parts before testing. We may disqualify your turbine if it looks dangerous. Send us a photo if you're unsure if your turbine is safe.

What do I need to do in order to compete?

Simple. Once you've constructed and tested your turbine, you will need to upload your data to our website so we can compare your turbine to your peers' all over the world. Since we can't come check on your turbine in person, you need to be honest when collecting and presenting this data!

You'll only be able to upload one trial to the Wind Turbine Design Challenge under your team's name. So if you do multiple trials, you will want to save your best turbine data and then upload that! We recommend downloading the student data sheet (you can find it on the upload page), filling a few out with data from multiple trials, and then uploading your best run at a later time.

About the data upload fields

Team Info

Tell us who's on your team! Input your team's name, grade level, and the teacher or coach's name and email.

You'll also be prompted to add a team description, where you should enter a short bio about the team and your turbine. Please **do not use full names** in the descriptions.

Basic Location Info

Fill us in on where you're from: city, state, and country.

Turbine Info

This section tells us a bit more about your turbine design. We want to know the number of blades, the type of drivetrain, and what kind of generator you used. We also need a photo and an optional video. Please **do not include faces** in the photos or videos. You have the option to upload a research report if you have some findings to share. Remember, a well-written and considerate research statement may earn you extra points in the judging process!

Turbine Performance

This is the bulk of your data. There are several important categories:

- Wind Speed: How fast is the wind blowing? If our Fan Speed Cheat Sheet doesn't include your fan, you can use a commercial or homemade anemometer to determine the wind speed.
- Rotor swept area (cm^2): How much area do your blades sweep? Note this is not just diameter! You need to calculate the area based on the type of turbine you designed (see Figure 1).

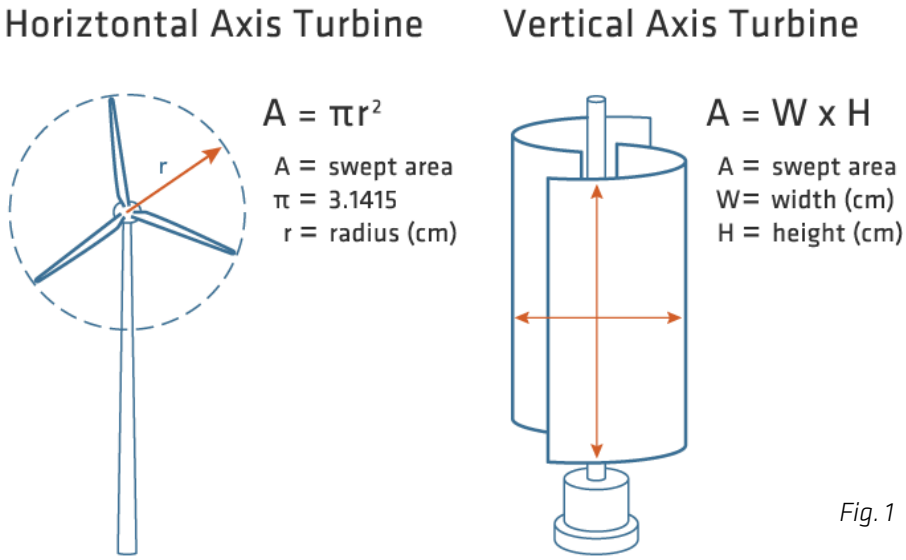


Fig. 1

- Resistor: What is the value of the resistor you used? KidWind kits come with 30, 50, 100 ohm resistors but you can check using a multimeter (see Figure 2).
- Measured voltage: What was the highest measured voltage across your resistor? You'll need a multimeter to know this (see Figure 3).
- Power (auto-calculates): How much power does your turbine generate? We use Ohms Law and your voltage and resistor readings ($P = v^2/r$).
- Efficiency (auto-calculates): How well is your turbine converting the maximum power available to it into electricity? This is the most important number. From the electrical data you provided (voltage and resistance) we know how much power your turbine is producing. From your swept area and velocity data we can calculate theoretical maximum power. Using these two numbers we can quickly calculate your turbine's efficiency! According to Betz's Law, efficiency cannot be above 59.3% - even for a perfect turbine - so if you've miscalculated something and gotten a higher percentage the form will not allow you to submit. Please double-check your variables and resubmit. If you have questions, you may call KidWind at any time for advice!

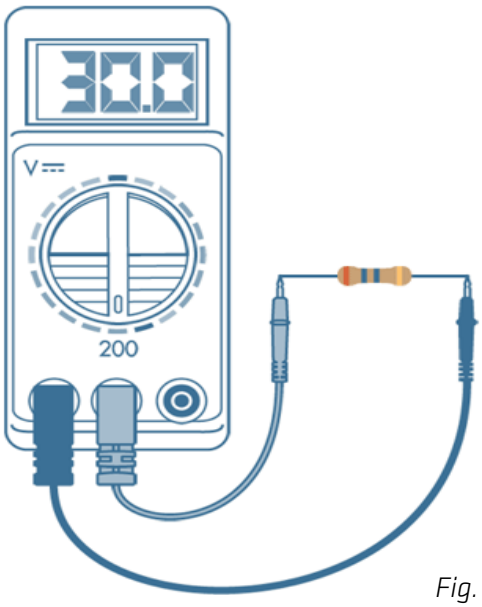


Fig. 2

How can I be disqualified?

We generally know the output parameters of wind turbines of this size. If our judges feel like your data is outside of the normal range, or that you did not follow basic rules, we'll send you a note to verify if you made a mistake or ask you to send some video to prove your case. If we feel that the data still cannot be verified, your turbine will be disqualified from the competition.

How do we choose monthly winners?

Your turbine will be compared to other wind turbines uploaded that month. If there are fewer than 5 teams competing, your submission will be considered in the following month's competition, or when there are 5 or teams. We keep our eyes on a few main criteria:

- Performance. We are looking for efficient, high output machines.
- Creativity. We are looking for innovation in design and use of materials.
- Quality. We are looking for turbines that look like someone put care into building them.
- Demonstrated Knowledge. We are looking for teams who understand their turbines really well.

Once a month we pick one winning team. They will receive a $50 check and a feature in our winners section!

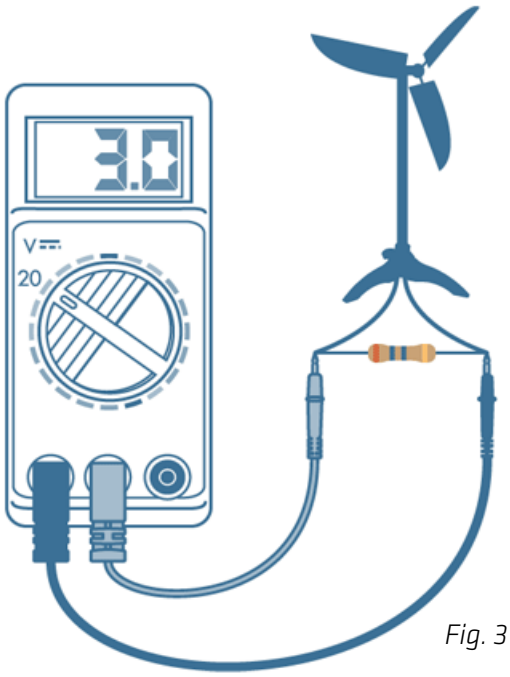


Fig. 3