Turbine Design Challenge

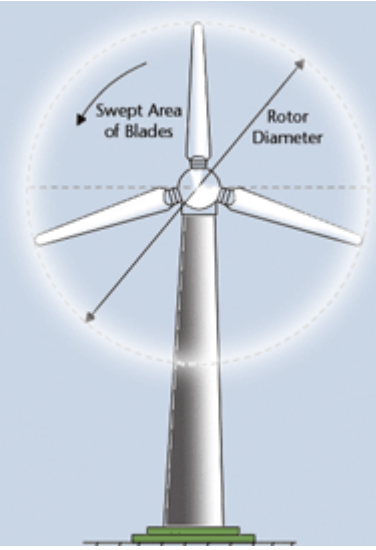
Introduction

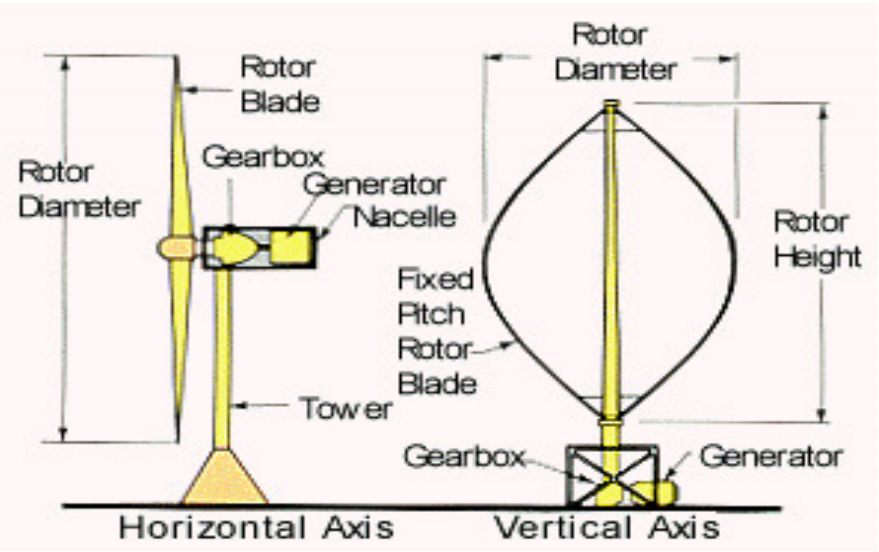
Wind power is the 2nd most abundant renewable energy source available after solar power. Using the wind for productive purposes is not a new concept. People have been utilizing the wind all throughout history. Today, as scientists continue to explore the use of alternative energy sources, they are discovering that wind energy has high potential. Through this design challenge, you will see firsthand how to harness the wind for productive work which will be used as a measure of energy generation capacity.

Objective

Your challenge is to design a wind turbine (HAWT or VAWT) that has the ***ability to harness the power of the wind to do work***. Your turbine will need to lift/pull a load. The amount of weight your turbine is able to handle corresponds to the energy generating potential of your turbine. The more weight your turbine can safely and steadily lift, the more electricity generating power it has.

→ Your design will be graded based on build quality, use of materials, capacity for energy generation, as well as consideration for the creative and design process.



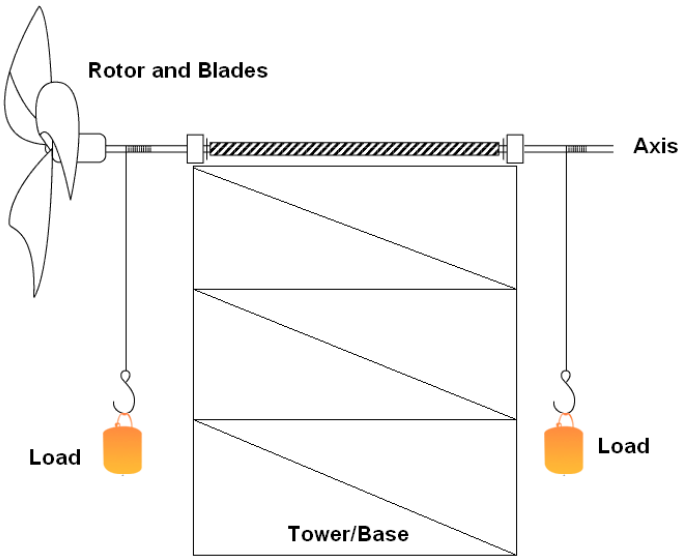


Materials

Be creative! Be resourceful and use materials that are available to you in the science lab as well as around the house at home. There is no need to buy materials for this design challenge.. Keep in mind that the objective of this design challenge is to simulate electricity generation potential. This means that you will want to use sturdy and efficient materials that will allow your design to best harness the wind.

Essential Components – Your design MUST include the following parts:

- Base or Foundation and Tower
- Axis (either vertical or horizontal)
- Rotor and Blades
- Load Carrying Ability



Procedure

- ☐ Begin by choosing which wind turbine configuration to design: HAWT or VAWT.
- ☐ Once a decision has been made, consider the materials you would like to use. Remember the goals as well as grading criteria as you choose your materials.
- ☐ Draw a diagram of your turbine below. Include labels for the parts as well as the material for each part.
- ☐ *Be thorough in your design!! The more thought and planning you put in now will help as you begin to build your turbine. This will also help you troubleshoot during the building of your turbine.*
- ☐ Gather the necessary materials and begin constructing your turbine.
- ☐ Test the sturdiness of your turbine and check to see if any re-design needs to take place.
- ☐ When completed, experiment with your turbine to see what sort of load it is able to handle.

Diagram of Wind Turbine

Draw your design in the space below. Be sure to include LABELS for each component

Results
Your turbine will be tested at 3 different distances from the fan. The further you are from the source of the wind will correspond with wind strength.
→ *Record your results in the table below.*

	3 feet	2 feet	1 foot
Weight of load			

Analysis
Why did you choose your particular type of turbine? (HAWT or VAWT) Did you have an initial idea of which configuration would be more efficient?

Explain the reasoning behind your choice of materials. Discuss your consideration of aerodynamics, weight, reliability, and creativity..

Did this design challenge surprise you regarding the different turbine configuration types?

What changes and modifications would you make to your turbine in version 2.0? Why?

Conclusion
What is your own self-evaluation regarding the final product of your group? What are your concluding thoughts regarding wind energy? Do you think it is a viable option for the US? For SF? For your home? What are some concerns or questions that you may still have?

Wind Turbine Design Challenge Grading Rubric

	5	4	3	2	1
Build Quality	Turbine is sturdy and it is obvious that attention has been paid to the details	Turbine is sturdy but some details have been overlooked	Turbine is somewhat sturdy and some details have been overlooked.	Turbine is somewhat sturdy but looks like it was done hastily	Turbine is not sturdy and looks like it has been poorly constructed
Design Diagram	Thorough diagram that includes labels on all parts as well as the different materials used.	Diagram is complete but not very detailed. Some labels missing.	Diagram shows the general idea and only has a few labels for the parts and materials.	Diagram is unclear and is missing important labels on parts as well as materials.	No diagram included and no labels are present.
Use of Materials	Creative use of materials that shows consideration to the purpose and objectives of the challenge	Varied use of materials with some level of creativity and originality demonstrated	Varied use of materials with little creativity demonstrated	Little diversity in the materials used showing a lack of creativity.	Poor choice of materials that shows little creativity or effort.
Capacity for energy generation	Can lift/pull a significant load with stability and ease	Can lift/pull a good amount of load.	Can lift/pull a standard amount of load	Is able to barely lift/pull a load	Is unable to lift/pull any load.
Creative Process	Shows great effort in making the design pleasing to the eye and unique	Shows effort in making the turbine pleasing to the eye	Shows some effort in making the turbine pleasing to the eye	Shows little consideration for the overall appearance of the turbine	Looks poorly constructed with no consideration for its appearance
Design Process	Engaged and involved throughout the design process. Effective communication among group members.	Engaged and involved with some off-task behavior. Group communication unbalanced with a few dominant voices.	Rarely contributed and did not take ownership over the project. Ineffective communication.	Tried to contribute but was more disruptive than helpful. Group communication lacking with disruptive arguing.	Did not contribute in a constructive manner. Group did not work well together and was unable to collaborate.
TOTAL SCORE	/30				