

Variable

What variable will you test for your experiment?

Answers will vary. Example variables: Blade pitch, blade shape/size, material of blades, number of blades, etc.

Constants

What variables do you have to keep the same (constant) as you perform this experiment?

Answers will vary. Example variables: Blade pitch, blade shape/size, material of blades, number of blades, etc.

Experimental design

Describe how you will perform this experiment.

1. What materials will you use?

Answers will vary. Balsa, corrugated plastic, paper plates, cardboard, etc.

2. How many times will you change your variable?

Variable should be tested at least twice, although it will be more difficult to gain information from a 2-point graph.

3. How long will you run the test?

Answers will vary. Trials should last at least 20 seconds.

4. How will you change your variable?

Answers will vary.

5. What will you use to measure your output?

Output should be recorded using a multimeter or other quantitative measurement.

Hypothesis

6. What do you think will happen?

Students should hypothesize about how changing their chosen variable will affect the power output of the wind turbine.

7. Why do you think this will happen?

Students should explain why they think changing the variable will affect power in this way.

What happened?

1. How did the voltage change as a result of manipulating your variable?

Changing the variable should cause the voltage to increase or decrease.

2. What was the optimal setting for the variable that you tested?

Which trial yielded the most voltage? For example, if the test variable is "blade pitch," students may answer "Blades pitched at 20 degrees produced the most voltage."

3. Do you think that your variable has a large or small effect on how much power the turbine can make?

Answers should include a justification on why they responded the way they did. For example, if they are testing blade material, they should include their readings for each material type, and try to explain that x material seemed to create more drag and decrease power output than y material. Answers will vary.

4. What problems did you encounter as you performed your experiments? How could you fix these problems?

Answers will vary. One common problem is that it is hard to keep all other variables constant while testing one specific variable.

Class results

1. If you were a lead design engineer, what would you recommend your company do to their turbine blades based on the class results? Why?

Students should describe the optimal blade design based on class results. This answer should discuss at least three variables—e.g., length of blades, number of blades, blade pitch, blade material, etc.