Name(s)	Project Number
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Project Title

Wind Power: The Quadric Solution

Abstract

Objectives/Goals

This experiment was about building the windmill best suited for generating voltage. I tested the number of blades and the angle of each blade. The amounts of blades used were two, three, four, and six. The angles used were from 0° to 50°. After testing, I derived quadric formulas, predicting the outcomes for any number of blades and angles.

Methods/Materials

To be able to test, I needed a windmill. This windmill is made of PVC pipe for the base, a PVC clip to hold the windmill, a hub, a small motor that has an LED light, six metal rods, and six blades. I was able to spin the windmill by using a shop vacuum. The vacuum was mounted on the table and was a constant factor. I used a multimeter to learn the voltage generated.

Results

After initial testing, the optimum angle for the two-bladed windmill was 25° with an output of 1.941 Volts; the optimum angle for the three-bladed windmill was 20° with an output of 2.2 Volts; the optimum angle for the four-bladed windmill was 15° with an output of 2.4 Volts; and the optimum angle for the six-bladed windmill was 20° with an output of 2.39 Volts. I then did more research and derived a quadric formula giving the predicted outcomes for any amount of blades. The second round of testing found 25° to still be the optimum angle for the two-bladed windmill, 19° was the optimum angle for the three-bladed windmill, 16° was the optimum angle for the four-bladed windmill, and 21.5° was the optimum angle for the six-bladed windmill.

Conclusions/Discussion

After much testing and researching, my first hypothesis that states four blades would be the best amount of blades for the windmill was correct. My second hypothesis that states 40° would be the best angle was very wrong. There was a different angle for each set of blades: 25, 21.5, 19, and 16. I concluded that these discrepancies were due to fact that the established formulas presumed conditions that did not include dynamics such as other air currents, slight inconsistencies, and human error. The test conditions for my experiment included all of these factors. However, using the test data, I was able to derive my own mathematical formulas that accurately predicted the outcomes in my testing environment. This could be useful for people who would like to go further and build a windmill of their own to generate their own electricity.

Summary Statement

I built a windmill to test voltage output as well as creating quadric formulas to predict any outcome.

Help Received

Teacher taught me how to figure out the formulas and a physicist gave me some deeper research