CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

J0117

Project Title

The Intensity of Wind

Abstract

Objectives/Goals

Our question is: What blade shape is most aerodynamic, with the least drag, to make a wind energy rotor spin faster, causing more electricity to be generated?

We hypothesized that blades similar to the shape of a leaf or bird wing would be the most aerodynamic, generating maximum electricity. Our goal was to create a blade based on aerodynamic shapes, such as the wing of a bird where the shape of the blade is 3-D, the tip of the blade is narrow, and where the bottom of the blade would be twisted to give the blades more torque and generate lift. We are trying to design a blade that could harness the power of the wind.

Methods/Materials

We used PVC pipes to make our stand for the wind energy device. A DC motor is connected to a hub for the blades. This is the rotor.

We then glued the wooden spokes to the material we used for our blades: coroplast, manila folder, and poster paper, creating 7 different blade shapes. The blades were connected to the plastic hub that was connected to the motor. Our wind source is a twenty inch fan. We tested the blades at different pitches using a protractor to measure the degrees. We tested for volts on a multimeter. We used what we learned to keep testing and refining our blade design. The addition of a gear box with gears at a ratio of 7 to 1 increased the velocity of the rotor.

Results

After preliminary wind testing, Blade 2, a flat leaf shape design, measured one volt on a multimeter. The increased length and 3-D twisted shape of the phoenix airfoil blade resulted in an increase of 5 volts, at maximum of 6.29 V. Voltage measured ranged from 0.4 V, blade three arrow shape, to 6.29 V, blade six, the phoenix blade. Further increasing the pitch beyond 10 degrees at the wrist of the blade did not increase the voltage.

Conclusions/Discussion

The hypothesis was proven correct. The bird wing airfoil blade shape captured the most wind speed just like a falcon wing. The difference between the flat blades, 1-5, and the 3-D airfoil blades was dramatic, a difference of 5 volts. The 3-D bird airfoil phoenix blade gave the best performance.

Finding blade shape designs that will capture the maximum wind energy to generate clean electrical energy is crucial. Our project is part of the science and engineering study of aerodynamic shapes such as the falcon wing and humpback whale fin. This will guide us in designing a more efficient blade and capturing the energy of the wind.

Summary Statement

How do bird wing shaped blades affect maximum wind power?

Help Received

Teachers, Ms. Ward, guidance and materials, Mr. Donovan, constructing a gear box, MLMS STEM Lab for testing our device