CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

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Project Number

J0117

Project Title

The Effects of Different Blades on Generating Electricity at Low Wind Speed

Abstract

Objectives/Goals

The current wind turbine design can generate electricity only at a high wind speed. The objectives of this project were to evaluate the blade type that would produce the most electricity and compare the effects of blade size, angle, and sweep area on energy production. The goal of this project was to develop a more efficient blade design for generating electricity at a low wind speed.

Methods/Materials

The materials used include: DC motor and stand, 18V battery, a fan, multimeter, wires, wooden craft sticks and plastic cups (for blades), drill and glue.

More than 14 different types of wind blades were made using craft sticks. The blades were attached to a generator, and a multimeter was used to measure the current and voltage. For each blade different conditions including wind speed and distance of a wind source were tested. The blades varied from 6 cm to 25 cm in length. For each blade, several tests were conducted, but two conditions (low & high wind speed) were used for final tests where low, high and average amps and volts were recorded for each test.

Results

The electricity produced by each blade (watt) was calculated by multiplying the volts and the amps measured during the experiments. The highest electricity producing blade was a small horizontal blade with a variable blade angle at high wind speed. Approximately 160 mW of power was produced from this design. This provided about 100 times more electricity than the worst blades. For the low wind speed however, vertical blades produced more energy as some horizontal blades did not even turn at low wind speed. The general formula for estimating the wind energy is based on the blade area where the wind is exerted. However, the experiments demonstrated that area is not necessarily the most important factor in power production for wind blades. In fact, the largest blade, 5 times more area than the most efficient one, produced less than 1% of the power from the smaller blade.

Conclusions/Discussion

The horizontal blade was the most efficient at the high wind speed; however for low speeds, the vertical blades produced more in power by harnessing the low wind. Based on the tests, how the blade harnesses the wind is more important in producing more electricity as it is related to efficient spinning of blades.

Summary Statement

This project evaluated different types and configurations of wind turbine blades (vertical and horizontal) for optimal energy production at low wind speeds.

Help Received

Father supervised and helped in designing of blades, teacher reviewed written material