CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Cannon M. Armistead

Project Number
J0203

Project Title
Blade Design: Energy for Generations

Abstract

Objectives/Goals
The purpose of my science fair project is to understand and demonstrate the creation of wind energy through the process of observing blade design variations on the energy production rate of a wind turbine. This project will include learning about the main components of a wind turbine and the basics of how a generator works and how it can turn physical work into electrical power.

Methods/Materials
After building my wind turbine, I used an 18" fan to simulate wind in a controlled setting. By changing blade materials, number of blades, and the angle of the turbine shaft, I was able to observe and record 99 different scenarios with an anemometer.

Anemometer, Multimeter, Alligator clips, Balsa wood (1/8", 1/16", and 1/32" thick), Cardboard, Super glue, Wooden dowels, Tape, Model wind turbine kit, Fan, Scissors, Wire strippers, LED light

Results
The heaviest material, balsa wood 1/8", was most productive and the lightest material, cardboard, was the least productive. The upright position of the turbine shaft was the most productive. Using three blades proved most productive.

Conclusions/Discussion
Many laws of physics came into play when my wind turbine was generating electricity. Two of these laws are inertia and drag. Inertia explains how objects in motion are resistant to change. Once the turbine blades are moving, they have a natural tendency to continue to rotate in the same manner and direction. Drag refers to the laws of physics that govern opposing forces to an object in motion. In this case, drag is a result of blade length beyond the area of wind exposure. As a result, the longer blades resided outside of the wind generation "tunnel" and therefore created drag, which decreased the rotational speed of the turbine and ultimately generated less electricity. Newton's third law is the driving force behind wind generation. By changing the angle of the blades, they are exposed to different amounts of wind. The most electricity is generated when the most wind is focused on the maximum surface area capable of the blade. Newton's third law is evident through the blades taking the force of the wind and transforming it into the inertia in the blades. This inertia drives gears of the motor and creates electrical energy through the generator. When the shaft is leaning forward or backward, the wind encounters the blades in a non-uniform fashion therefore causing it to be less productive.

Summary Statement
The purpose of my science fair project is to understand and demonstrate the creation of wind energy through the process of observing blade design variations on the energy production rate of a wind turbine.

Help Received
Mother helped glue materials on board; Father answered some of my questions