Name(s)	Project Number
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Project Title

Harvesting Wind on a Blustery Day

Abstract

Objectives/Goals
The objective of this experiment is to evaluate the impact of blade count on the electrical output of a Horizontal Axis Wind Turbine (H.A.W.T.) at a constant wind speed of 21 kilometers per hour, the wind speed typical of a residential area. A common hypothesis is that the wind turbine with the highest number of blades (eleven) will generate the most electricity because of a maximum windswept area.

Methods/Materials
A tower made from PVC plumbing pipes, a pre-manufactured nacelle, and an umbrella stand was placed in front of a large industrial house fan that was set up to generate a wind speed of 21 kilometers per hour. A voltmeter was used to measure the electrical output of five wooden turbines with three, five, seven, nine, and eleven blades. Each variation was tested five times.

Results
Contradicting the hypothesis, the turbine with nine blades generated the most power rather than the turbine with eleven blades. The trend of the average graph is represented by the quadratic equation $y = -0.0029x^2 + 0.054x + 0.4609$. In the equation, the x variable is the number of blades and the y variable is the voltage generated. By substituting the x variable for the values 8, 9, and 10, it can be proved that the turbine with nine blades will usually generate the highest voltage, for it is also the apex of the parabola.

Conclusions/Discussion
To a certain extent, the energy generated by a wind turbine does increase with the number of blades. However, when blade count reaches a critical number, wind turbine function destabilizes due to the weight of the turbine and impairment of airflow through the fan blades. In the future, residential wind turbines may be altered to achieve optimal performance. Energy generated from wind turbines is directly correlated with wind swept area until blade weight and airflow limitations become pernicious variables.

Summary Statement

The objective of this project is to find the ideal number of blades on a Horizontal Axis Wind Turbine in a residential area.

Help Received

Father helped shape the wood of the turbines; grandfather explained the mechanics of wind power.