



# CALIFORNIA STATE SCIENCE FAIR

## 2007 PROJECT SUMMARY

Name(s) <b>Joshua M. Arreola</b>	Project Number <b>J0103</b>
<b>Project Title</b> <b>The Powerful Windmill: Creating the Most Efficient Windmill Blade</b>	
<b>Objectives/Goals</b> The objective was to determine what blade factors (length, shape and the number of blades used) on a windmill would produce the most energy output at a high wind speed. By creating three various shapes and sizes, and using two different blade designs, I hypothesized that a 12.7cm by 2.54cm sickle-shaped four-blade design would produce the most energy output.	<b>Abstract</b> A windmill was built out of Tinkertoys. Twenty-four blades made out of balsa wood were cut out into three different shapes and sizes: rectangular, trapezoid and sickle-shaped at 10.16cm by 2.54 cm, 12.7cm by 2.54cm, and 15.24cm by 2.54cm (eight of each shape and size). The blades were placed at a 20° angle on a windmill hub using two different blade designs (a four-blade design and an eight-blade design.) A DC motor was attached to the windmill, and a multi-meter was hooked up to the output of the motor to read and record the DC voltage. A room fan set at high speed was used as the wind source, and was placed one meter away from the windmill. Each design was tested for thirty seconds. A total of eighteen tests were conducted from all the blade designs.
<b>Results</b> The overall results showed that the four-blade designs produced more energy output than the eight-blade designs. The 10.16cm by 2.54cm sickle-shaped four-blade design produced the most energy output, and the 15.24cm by 2.54cm sickle-shaped eight-blade design produced the lowest output.	
<b>Conclusions/Discussion</b> My results showed that my hypothesis was incorrect. My background research shows that using shorter and fewer blades on a windmill should produce more energy output. For future experiments, I might change the variables such as the blade pitch, materials used, and/or the weight of the blades. I would then isolate and test each blade design variable one at a time. And finally, I would run more trials for better accuracy of my results. This experiment can benefit society by aiding in the creation of an efficient blade design for energy production. This could also help to reduce the use of fossil fuels in order to create a safer, cleaner environment.	
<b>Summary Statement</b> This project was conducted to determine what blade design factors on a windmill would produce the most energy output.	
<b>Help Received</b> Mr. Hellman (Math teacher) explained how to measure the blade angles on my windmill hub. Dad advised on how to place the motor on my windmill and how to use a multi-meter. Mom assisted with purchasing the materials, taking pictures, and pasting some of my board.	