



**CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY**

Name(s) Brian T. Kim	Project Number J0113
Project Title The Effect of the Blade's Pitch Angle on Wind Power	
Objectives/Goals This study examined the effects of different blade pitch angles on the rotor speed (RPM) and the generator power.	
Abstract Methods/Materials First, a wind tunnel was made with cardboard and placed on a fan, achieving sufficient wind speed (5 m/s or 10 mph) to turn the propellers. Then, the rotor blades and hub were made with balsa and poplar wood, respectively. Among four different combinations of gearboxes and generators, the 5:1 gearbox and the RE 260 motor combination was selected. The number of blades experiment showed wider blades performed slightly better, but the 2.54 cm wide two-blade propeller was selected for easier manufacturing and structural strength. A laser tachometer was used to measure the rotor speed (RPM). Two experiments were performed. In the pitch angle experiment, flat blades of different pitch angles were compared, while the twisted, flat and curved blades were compared in the aerodynamic blades experiment.	
Results In the flat-blade pitch angle experiment, the 10° blades turned fastest at 1820 RPM with no load. However, when blades were attached to the generator, the 15° blades produced the most power (0.113 Watts) at 1180 RPM. In the aerodynamic blades experiment, the twisted blades with varying pitch angles of 10° at the tip increasing to 20° at the hub produced the most power (0.192 Watts) at 1390 RPM. The output power increased by 41% compared to the 15° flat blades.	
Conclusions/Discussion The twisted blades, when the flatter surface was facing the wind, produced the most power. There are two reasons. First, the twisted blade is curved, producing more lift because it is more aerodynamic. Second, the blade's pitch angle increases from 10° at the tip to 20° at the hub. Since the blade speed is lower near the hub, the higher pitch angle is needed there.	
Summary Statement This study examined the effects of different blade pitch angles on wind power.	
Help Received Mom helped make the board, while Dad helped make the propellers and understand some aerodynamics concepts.	