



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Eleanor O. Frost	Project Number J0109
Project Title Blades of Glory: A Study of Producing Electric Power from Wind Energy	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals MY STUDY EVALUATES THE ELECTRIC POWER PRODUCED BY THREE DIFFERENT WINDMILLS AT THREE DIFFERENT WIND VELOCITIES. EACH EXPERIMENT WILL COMPARE THE POWER PRODUCED TO THE THEORETICAL MAXIMUM, BETZ' LAW.</p> <p>Methods/Materials I BUILT A WIND TUBE AND A WINDMILL. THE WIND TUBE WAS MADE OUT OF A HOUSE FAN AND PLASTIC SHEETING. THE FAN HAD THREE DIFFERENT SETTINGS. THE WINDMILL USED THREE BLADES WITH THREE DIFFERENT ANGLES: 45, 30 AND 15 DEGREES. I USED A MOTOR FOR A GENERATOR. FOR EACH EXPERIMENT I MEASURED AT THREE LOCATIONS THE WIND SPEED AT THE MOUTH OF THE WIND TUBE WITH AN ANEMOMETER. I THEN PLACED THE WINDMILL AT THE VERY FRONT FRONT OF THE WIND TUBE. AFTER REACHING A STEADY STATE, I MEASURED THE VOLTS AND THE AMPS THREE TIMES EACH WITH A VOLT AND AMP METER. FOR EACH BLADE AND FAN SETTING I RAN 6 EXPERIMENTS</p> <p>Results THE 30 DEGREE BLADE AT THE HIGH AND MEDIUM FAN SETTING PRODUCED THE MOST POWER AND WAS THE MOST EFFICIENT.(75% AND 43% MORE POWER THAN THE 45 DEGREE BLADE.) THE 45 DEGREE BLADE, HOWEVER PRODUCED THE MOST POWER AND WAS THE MOST EFFICIENT AT THE LOW FAN SETTING. THE 45 DEGREE BLADE EFFICIENCY WAS 3 TIMES MORE THAN THE 30 DEGREE BLADE AT THE LOW SETTING. EFFICIENCY WAS DETERMINED BY COMPARING OBSERVED POWER TO BETZ' LAW CALCULATION THE 15 DEGREE BLADE DID NOT SPIN FOR THE LOW OR MEDIUM SETTINGS. AVERAGE WIND SPEED FOR THE HIGH FAN SETTING: 8.46 METERS PER SECOND FOR THE MEDIUM SETTING: 5.71 METERS PER SECOND FOR THE LOW SETTING: 4.34 METERS PER SECOND</p> <p>Conclusions/Discussion THE BEST BLADE ANGLE FOR PRODUCING POWER DEPENDS ON THE SPEED OF THE WIND. THE BEST EFFICIENCY WAS 2.2% OF THE THE BETZ' LAW CALCULATION. THE DIFFERENCE IS DUE TO THE FLOW AT THE END OF THE WIND TUBE, THE NOSE OF THE WINDMILL, THE GAP BETWEEN THE BLADES, THE FRICTION, THE GEAR NOISE AND THE DRAG ON THE BLADE. I SUPPOSE THERE ARE ALSO LOSSES INSIDE THE GENERATOR.</p>	
Summary Statement A STUDY OF PRODUCING ELECTRIC POWER FROM WIND ENERGY	
Help Received DAD HELPED WITH DRILLS AND DATA COLLECTION; MOM AND DAD GAVE ME SUPPORT AND DROVE TO STORE FOR BOARD AND SUPPLIES AND TO LA COUNTY SCIENCE FAIR.	