



**CALIFORNIA STATE SCIENCE FAIR  
2013 PROJECT SUMMARY**

<b>Name(s)</b> Sidney E. Wilcox	<b>Project Number</b> <b>S0327</b>
<b>Project Title</b> <b>Comparing Horizontal and Vertical Axis Wind Turbines in Different Wind Conditions</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The objective of this experiment is to compare the efficiency and overall production of horizontal axis wind turbines (HAWT) and vertical axis wind turbines (VAWT) in different wind speeds and in wind coming from different angles relative to the turbine.</p> <p><b>Methods/Materials</b> In order to accomplish this, I built a horizontal and vertical axis turbine and, utilizing the same generator, built a base to mount the turbine on. I set up a rig where the fan had the ability to be positioned at zero and thirty degrees relative to the turbines. I measured the mAmps produced and the RPMs generated by the turbines in all combinations of conditions, such as high wind speed, zero degree angle with the vertical axial configuration and so on and so forth, until I had tested each of the combinations three times.</p> <p><b>Results</b> From this experiment, the data showed that the VAWT had a higher mAmps produced and RPMs than the HAWT. The vertical turbine also produced a higher percentage of its theoretical output than the horizontal turbine, even though the horizontal had a higher theoretical output. The higher wind speeds produced a higher mAmps and RPMs than the lower winds speeds in all conditions. The angle of the wind had no significant impact on the vertical axis wind turbine, but the angle was very significant for the horizontal axis wind turbine: the average mAmps produced at thirty degrees were only twenty percent of the average mAmps produced at zero degrees.</p> <p><b>Conclusions/Discussion</b> In conditions with relatively low wind speeds, the VAWT was by far more efficient than the HAWT. This result can be attributed to the fact that the HAWT has higher initiation energy than the VAWT. This means that the HAWT requires a higher wind speed in order to get started. To the contrary, the VAWT has lower initiation energy and works better in the lower wind speeds. The higher wind speeds result in a higher power available in the wind and thus a higher production. For the VAWT, there was a minimal difference because of the axial orientation: the cylindrical shape of the turbine allows it to harvest wind coming from any direction without any difference. HAWTs are a flat disk shape and, because of this, require the wind to come perpendicular to the front of the turbine.</p>	
<b>Summary Statement</b> This project aims to compare the horizontal and vertical axis wind turbines in different wind conditions in order to determine which is more efficient and has a higher production in different wind speeds and different angles of the wind.	
<b>Help Received</b> Father helped build the turbine.	