



**CALIFORNIA SCIENCE & ENGINEERING FAIR  
2018 PROJECT SUMMARY**

<b>Name(s)</b> <b>Jonah Z. Bard</b>	<b>Project Number</b>  38620
<b>Project Title</b> <b>Wind Turbine Layout Optimization for Energy Efficiency</b>	
<b>Objectives/Goals</b> The objective of this experiment is to ascertain the energy generation differences between varied placements of wind turbines. <b>Methods/Materials</b> A 6ft x 12 ft x 4ft wind tunnel was constructed from a metal frame and large tarpaulin to maintain airflow, coming from six box fans. Six small-scale wind turbines were placed in different configurations, including a staggered group (based on migrating bird formations) and a stacked group (turbines places one in front of the other), in addition to varying spacing between rows within each group. Voltage was measured and recorded six times for each arrangement, with a system of switching the turbines around, so each turbine could be placed in every possible position. <b>Results</b> The results showed that one-in-front-of-the-other (stacked) configurations will generate more energy than staggered configurations. Overall averages comparing the groups showed that the stacked group produced .9V, 20 percent more than the staggered group, at .75V. The results additionally showed that with the increase in spacing of turbines, energy decreased, at an average of .0475V for every 4 inches. <b>Conclusions/Discussion</b> Contrary to the hypothesis, closer, stacked spacing of wind turbines maximized energy production. The experiment presented rough but constant averages which can be helpful as supporting data for additional experimentation. If confirmed by additional tests, the information could lead to greater efficiency in wind turbines, advancing the field of renewable energy.	
<b>Summary Statement</b> I determined the most energy-efficient relative placement configurations of wind turbines.	
<b>Help Received</b> Science teacher provided input for design of experiment and feedback for parts of report, math teacher gave input on wind tunnel design, family helped build wind tunnel	