# CALIFORNIA SCIENCE & ENGINEERING FAIR
## 2018 PROJECT SUMMARY

**Name(s)**
Arthur Kumalo Alm

**Project Number**
**J0101**

**Project Title**
## Bicycle Wheel Wind Turbines

**Abstract**

**Objectives/Goals**

The idea of this test is to find out what the most efficient way is to wrap duct tape around bicycle wheel spokes to turn them into wind turbines. I will test two blade designs, blade design a having nine solid blades and blade design b having eight split blades.

My question is what blade design, a or b will generate more electricity?
My hypothesis is that it will design a will have a larger power output.

**Methods/Materials**

My original plan was to put both wheel designs, (at separate times) next to a fan. The wheel would turn a generator, and the voltage drop across a resistor would be measured. I'm going to try 1 ohm, 10 ohm, and 100 ohm resistors. Using Ohm's law, i=v/r, I can find the current. Then I can multiply the current by the voltage to get the power. However, the generator we had would not be spun by the wind with either blade design, even when the wheel was moving at about 240 rpm.
I did have a wheel with a generator built into the hub, which I was able to get spinning in the wind with design b at around a Beaufort wind scale of four. I then modified my plan to
1.Test for the better blade design just as in my original plan, but without the generator,
2.Put whichever design turned out to be better on the wheel with the hub generator, and
3.Do more tests with the new wheel.

**Results**

Design A on average reached 97 rpm, but that included an outlier test that got up to 110 rpm. When I deleted the outlier test, the average came out to 86 rpm. Design B on average reached 97 rpm. The torque on design a was .0465 Newton metres (Nm), as compared to .057 Nm on design b.

**Conclusions/Discussion**

I found that design b is a more efficient wheel design, and I will continue to do real world tests with design b.

The fact that the generator wouldn't turn when the wheel was going 240 rpm was surprising to me given the rough calculation that
A biker at a moderate speed would be going at about 10 mph,
27 inch diameter of the wheel would make about 90 inch circumference, or 7.5 feet,
5280/7.5 is aprox.700, making 700 rotations in a mile,

**Summary Statement**

I made two different designs of bicycle wheel wind turbines, and tested them with a fan and in various outdoor wind conditions for rpm, voltage generated, and torque.

**Help Received**

Art Alm, for helping me design and test my experiment, and Patty Freedman, my mentor.