The Evolution of 3 Turbines

TEAM TURBIN

Design Goals:

The goal was to make a turbine that generated as much power as we could, as well as being efficient with the cheap materials that were provided, using the design process. The requirements of the project were that it had to be made out of recyclable or cheap materials, couldn't be made of metal, and that it couldn't have a pinwheel design.

Materials List:

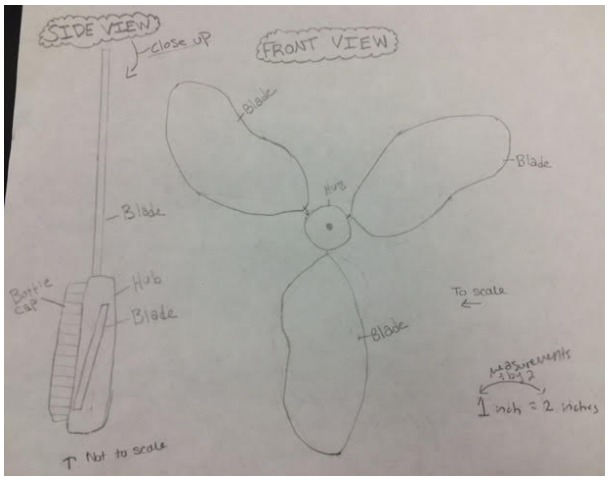
Boxboard
Hot glue
9 Chopsticks
3 Nuts
3 Bolts
3 Hubs
Scissors
3 Plastic Bottle Caps
Styrofoam (meat tray)
1 Medicine Bottle
3 Washers
3 Solo Cups
Drill Press

Design + Build Process #1:

The first decision that we made was how many blades we would have. We decided on three blades because it is less time consuming to make and also has more efficiency with materials than four to six blades. Then we decided what material we would use for our blades. We ended up choosing boxboard. We chose boxboard because it was durable and we thought that it would be easy to make our blade shape. Our last decision on this turbine was the shape and slant of the blade. We chose a curved C type look for our blade at a 45 degree angle. We chose this type of look for the blade because we looked at the other fans in the room and went by that look. We chose this angle for our blade because we wanted a slant for our blade so that the blades could slice through the air so we chose 45 degrees because it is half of 90 degrees which would be completely vertical. The dimensions of the blades were 6 inches in length and 3 inches in width. The biggest problem with this turbine was that one blade was heavier than the other two which caused the voltage to go way down. (Data Table 1)

Data Table 1.

Trial	Airspeed meters/sec	Voltage	Milliamps	Amps	Power
1	5.5	0.11	0	0	0
2	5.6	0.10	0	0	0
3	5.5	0.11	0	0	0



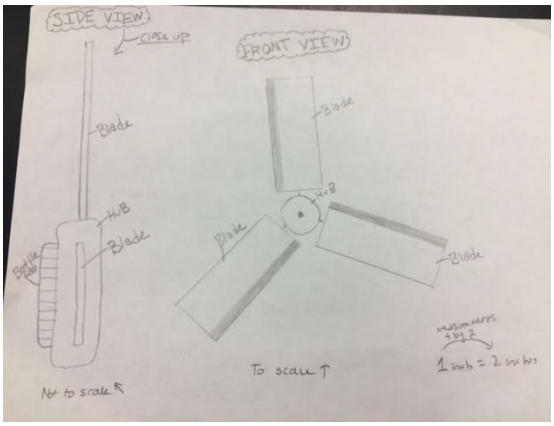
Design 1 Sketch *To Scale*

Design + Build Process #2:

The second decision was to move on to a lighter material, which was Styrofoam from a tray. We decided on Styrofoam because the boxboard was too heavy and the meat trays are light. We kept the three blade design idea and we decided to have a bit a of a curve to each blade as well as curved tips. This design was much easier to make because we didn't have to slant the blades at an angle we just designed them so that the base would be flat but the top would be curved. The main idea behind this design was to get a turbine that spun quicker and generated more power. The dimensions of the blades are 2 inches in width by 5 inches in length (Data Table 2)

Data Table 2

Trial	Airspeed meters/sec	Voltage	Milliamps	Amps	Power
1	5.6	1.0	0.14	0.00014	0.00014
2	5.6	1.03	0.14	0.00014	0.0001442
3	6.0	1.02	0.14	0.00015	0.000153



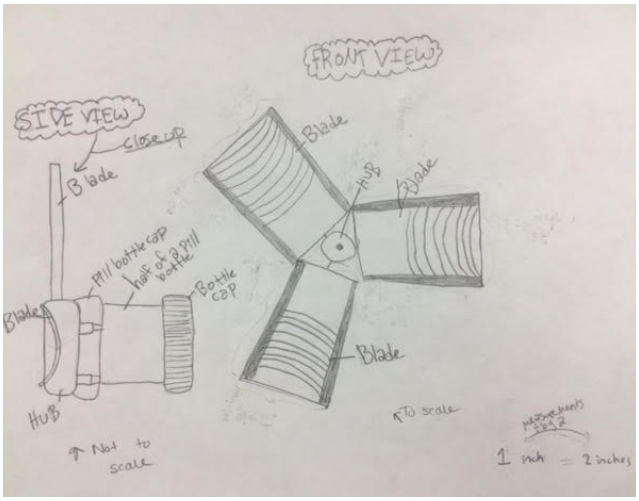
Design 2 Sketch *To Scale*

Design + Build Process #3:

The third decision was to have an even lighter material but have a lot of curves. We went with three blades again and the material we decided on was red solo cups. It was very easy to create. All we did was cut the cup in half (vertically) and round the corners. However we made a very unfortunate mistake and grabbed a hub and cut a medicine bottle in half. The medicine bottle was not cut evenly which made the blades slanted downward not getting all of the wind which lead to not generating much power. We also scavenged a hub that had three holes, but were unevenly spaced and that also contributed to our groups doubt in the turbine. The dimensions of the blades are 3 inches in width by 4 inches in length (Data Table 3).

Data Table 3

Trial	Airspeed meters/sec	Voltage	Milliamps	Amps	Power
1	5.7	0.53	0.000	0	0
2	5.7	0.55	0.000	0	0
3	5.9	0.54	0.000	0	0



Design 3 Sketch *To Scale*

Energy transfers and conversions

When the wind blows towards blades it is thermal energy and when the blades started to turn, it was mechanical. Once the blades spin it turns a high axle which turns a gear box which turns a low axel. All of those processes are mechanical energy transfer. Once the motor starts to turn, the energy turns into electric energy.

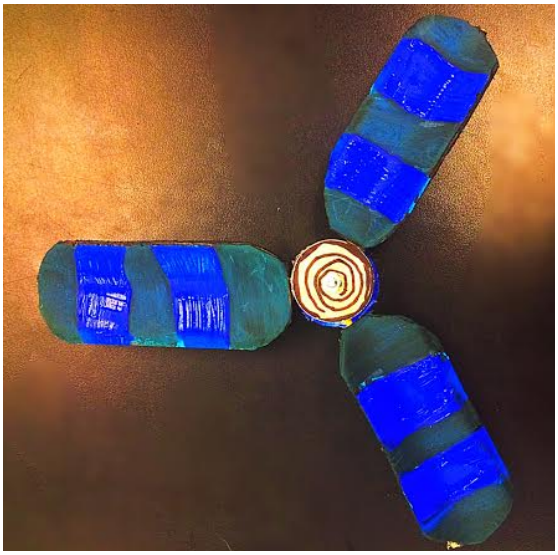
Most Effective Turbine

Our most effective turbine was our second design because it generated the most power averaging about 0.0005782 Watts, while the other two turbines failed to create power. We varied one variable which was the curvature. We did this by rounding the corners of our blades. We curved the blades because we researched what makes a turbine blade effective and noticed that curved blades are a trend in successful turbines, so after we tested our best turbine, we rounded the corners and got a better result. Also in our second design we used a lighter material at an attempt to generate more power and by using Styrofoam instead of cardboard. This also benefited the turbine's ability to generate more power because there was a very noticeable difference in the first and second turbine's power output because the second design actually produced power.

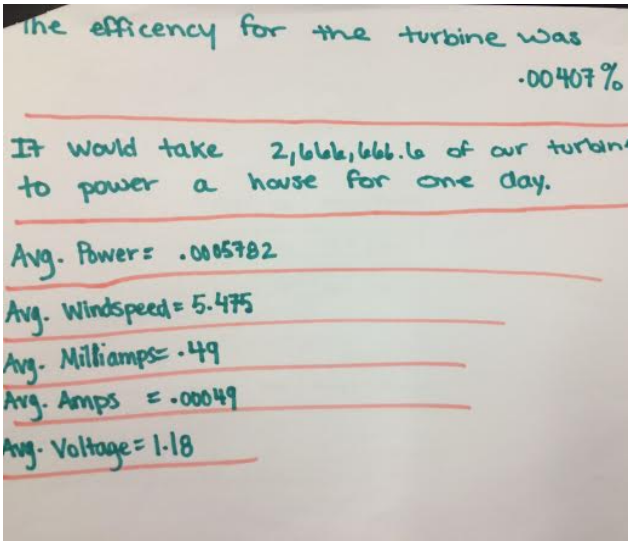
Conclusion

In conclusion, our second design was the most effective at generating power and was the easiest to make, most likely because of how even the blades were in size and in shape and because of what the material was. The other two designs had more noticeable shape and size differences and the second design also had rounded corners which also benefited to it's success. The foam tray was pre-curved so we didn't have to angle the blade which made it easier to make and decreased the mass of the blades because we could use less glue. The other two designs failed to generate power mainly because we believe that the blades were

unevenly spaced and shaped when we created them. Also to make our final design aesthetically pleasing, we painted the blades blue and black stripes.



Final Design



Averages

Resources

Mogielnicki, J., D. Harmon, J. Kramer, D. Lyons, D. Lentine, D. Taylor, and MC Baker. *Power in the Wind. Create It Lab*. N.p., n.d. Web. Mar.-Apr. 2016. <http://createitlab.org/static/pdf/PinWind_V29Sb_L.pdf>.

Meshram, Suchit. "What Is the Most Efficent Design for a Wind Turbine." N.p., n.d. Web. https://www.quora.com/What-is-the-most-efficient-design-for-a-wind-turbine