The Powerful 3 Blade Homemade Wind Turbine

Team: Green Mountain Breeze

Design Goals & Process:

Prior to the design/building process, we wrote down notes and ideas on sticky notes that we wanted to incorporate in our design. After this, we had an idea of what we wanted our turbine to look like. Our goals were to have the most powerful and efficient turbine in the class after testing 3 or more prototypes. As for the design, our goals were to have 3 blades that generate power. We had also received information from research regarding the blades to improve and help us out in our design process. We chose 3 blades for our turbine because we wanted the lowest number of blades in hopes of reducing overall weight – 2 blades seemed like not enough and 4 blades felt excessive. Further research also proved that 3 blades produced the highest possible amount of wind-generated energy the most efficiently (Notes). The wooden sticks on the backs of our blades support the blades and prevent them from bending. We also decided during the design process that we wanted curved blades since if the wind was pointed directly at it, then the wind would hit it head-on and bend our materials. Due to the curve, angle, and lack of flexibility of our blades, the turbine was able to fulfill our aspirations.

Blade Description:

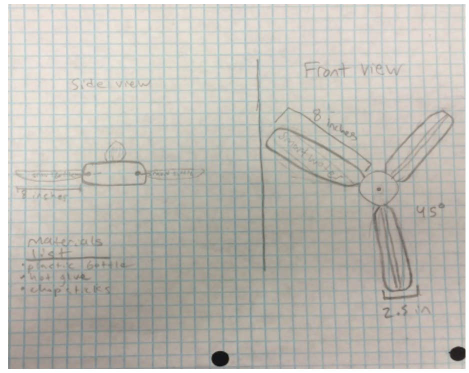
On our final design, we decided to go with the idea of using three blades on our turbine. Our reasoning for using three blades is explained in the research done in our design goals & process section. For all three blades, we used black Styrofoam trays as the material. We chose the black trays as a material because they were not flimsy, but also not thick enough to the point where the wind would bend it backwards. We improved the aesthetics of our prototype by putting multicolor duct tape to the edges and sticks of our turbine. Two more aspects of our turbine that are aesthetically pleasing to the eye is how all of our blades have the exact same dimensions and are all spread apart at the same distance.

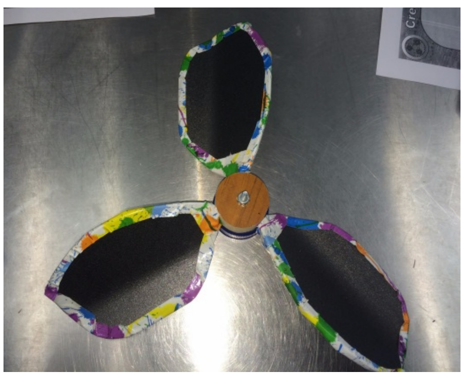
Revisions Discussion:

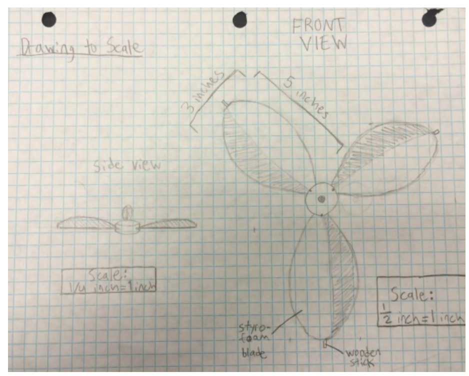
We ended up making our first design the one we would test since it produced the best results out of our five designs. Along the way we made many revisions on our first design and not all of them benefited us to their expected extent. An example of this is when we increased the length of the blades by one inch. We decided to make this revision because we had a lot of extra wind being blown to the sides and top that was not being collected by the fan. This revision did not help us as much as we thought and it is shown in our data when our first prototype had an average voltage of 1.43 V and our second prototype (the revised version of our first prototype) had an average voltage of 0.67 V.

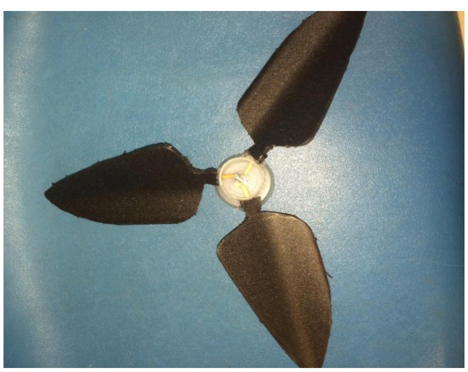
The pictures below are ordered in which they were created and tested (Design1-4).

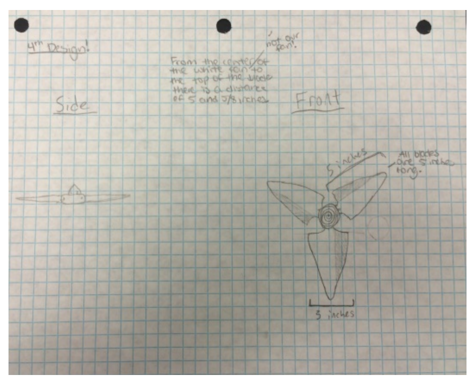
Designs	**Scale Drawings**

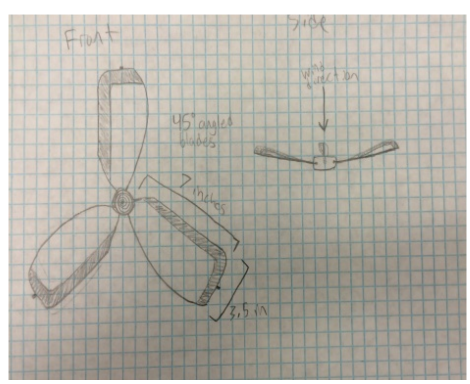












Data Table:

	Voltage (v)	Current (mA)	Windspeed (m/s)
Proto 1	1.47	1.35	6.2
	1.42	1.2	6.1
	1.42	1.2	6.2

Ave Power for Proto 1 = 0.0018W

	Voltage (v)	Current (mA)	Windspeed (m/s)
Proto 2	0.67	0	6.3
	0.67	0	6.3
	0.67	0	6.3

Ave Power for Proto 2 = 0W

	Voltage (v)	Current (mA)	Windspeed (m/s)
Proto 3	0.68	0	6.1
	0.65	0	6.2
	0.65	0	6.2

Ave Power for Proto 3 = 0W

Energy Transfers & Conversions:

The energy consumed by the blades is not automatically used up. The wind energy is transferred and converted many times before being generated and actually used. The act of the wind coming towards the blade is thermal. After this, the wind hits the blade. This process is mechanical since the wind is causing the blade to spin. After the wind hits the blade the wind generated energy is passed through the high axle, the gearbox, and then the low axle. These three actions are mechanical. The final thing done by the wind is what makes it produced electricity. It goes from the low axle into the electrical generator, which is also known as the engine in the turbine. All of this applied when we tested each one of our turbines, and after measuring things such as the wind speed (6.2 m/s), the voltage (1.43 V), current (0.00125 amps), and power of the turbine (0.0018 W), we were able to calculate the design's overall efficiency which was 0.009%. We also calculated that to power a single household for one 24 hour period we would need 740,741 of these turbines.

Conclusion:

In conclusion, our original design ended up being the one that worked the best for our group. In the end, the design we first invented was the one that we made the turbine we would do final testing on. This design had the highest volts and milliamps, which allowed our design to produce the highest possible amount of energy and speed. Our other designs were not chosen due to the fact that they didn't produce enough energy in comparison. Based on our trials, we worked to improve our first design because we could do many things to it to make it become what we were looking for. Each day we went class we prepared to do what the day may bring for the process of building the wind turbine(s), we brought the flexibility to complete a day packed with logical thinking to improve, and to participate in a cooperative group. Together we made the process of improvement easier.

Citations:

"Notes and Queries: Why Do Wind Turbines Always Have Three Blades? The Gents' Dilemma; Who Is This God – Aton or the Dude?" *The Guardian*. Guardian News and Media, 06 Sept. 2011. Web. 12 Apr. 2016.