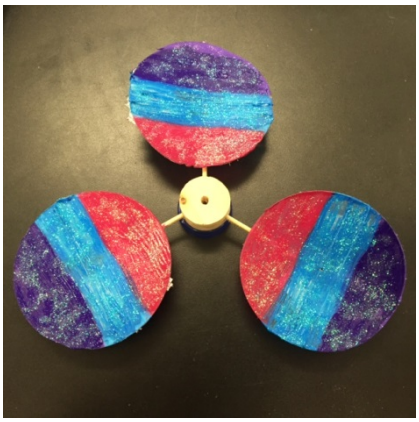
Wind Turbines

Team: Faze

Prototype #1:



First Prototype and Final Design
Output Power of Final Design: 0.002265 W

Design Goal:

With our first design, we were striving for our turbine to exceed a good wind speed, a good current, and a good voltage. Our goal was to have the current, wind speed, and voltage be good amounts that would even each other out. This would be a good scenario because for example if the voltage and wind speed were good but there was no current then the turbine would not be nearly as good as if all three were good amounts.

Why We Choose These Materials-
We chose these materials because they are strong yet flexible so that we can change the shape.

Why We Chose This Blade Design-
We chose this blade design because it is curved a certain way to catch the wind which will make the blades move faster. We chose to have three blades because we felt that three blades is a good number for our turbine in order to exceed our design goal for this prototype.

Design and Build Process:

Materials-

- Circular CD Cases
- Tape (Scotch and/or Duck)
- Fishing Wire
- Sharpies
- Bottle Cap
- Tinker Toy (3 Holes)
- 3 Skewers
- Hot Glue Gun
- Blow-Dryer
- Paint
- Glitter

Build Process-

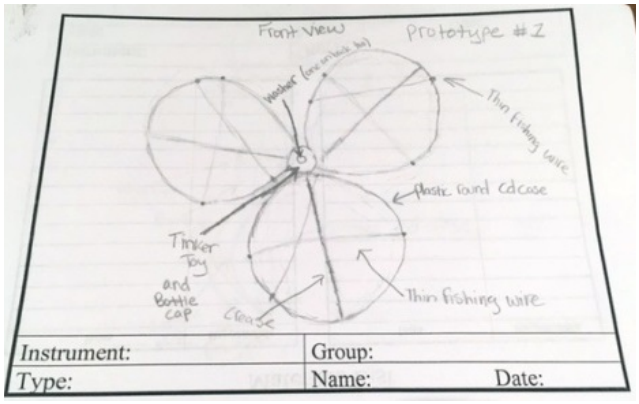
1. We cut the CD cases into identical circles.
2. We sanded the edges of the circles to make them smooth.
3. We used the blow-dryer to make the CD Case Circles more flexible.
4. We molded the CD cases into the shape that we wanted them in and tied a fishing wire to keep them in place.
5. We glued the skewers into the holes in the tinker toy.
6. We glued the blades onto the skewers at an angle where the wind will be caught in one blade and then transferred to the other blades. They were glued in a counterclockwise direction.
7. We painted the blades.
8. Lastly, we added glitter for shimmer effect.

Blade Description (Artistic Design Elements AND Dimensioned Diagrams):

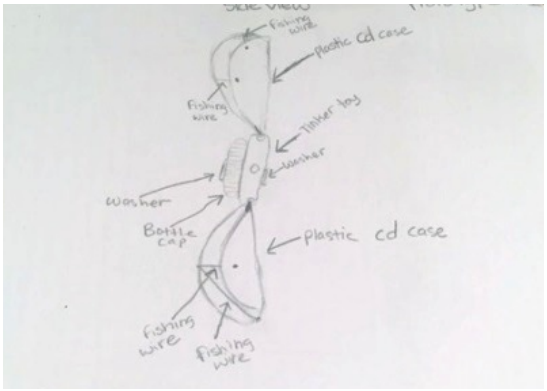
The blades in this turbine were made out of circular CD cases. We cut identical circles out of the CD cases. We then sanded the edges of the circles to make them smooth. We used a blow dryer to mold the circular objects. We molded them to have curved edges instead of staying completely flat because we believe that blades that are curved will produce more wind than flat blades. We used fishing wire to hold the molded shape in place. Then, we glued the objects to the skewers in a direction where each blade will catch the wind at a good angle and transfer it to the next

blade. To add some color to the blades, we painted the blades different colors and added some glitter to make our product sparkly.

Scale Drawings of Design 1

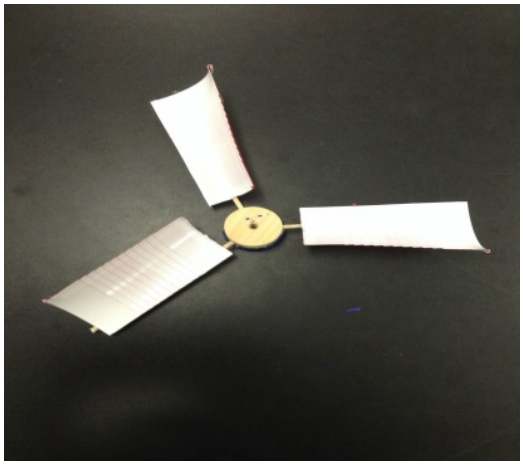


Front View



Side View

Prototype #2:



Prototype 2 Design

Design Goal:
With our second design, our goal was to create a turbine with a greater wind speed. We wanted to make a turbine with a greater wind speed because we wanted to make a turbine that creates more wind than the other turbines.

Why We Chose These Materials-
We choose these materials because the red solo cups have the right amount of flexibility so that we can shape them a certain way. They also are thick enough so that the turbine blades won't be flimsy.

Why We Chose This Blade Design-
We chose this design because the shape of the blades would catch the wind well which will make the turbine move faster. Creating blades that will make the turbine create more wind will help us to accomplish the goal that we created for this turbine. We chose to have three blades for this turbine because we felt three was a good number of blades in order to exceed our design goal for this prototype.

Design and Build Process:

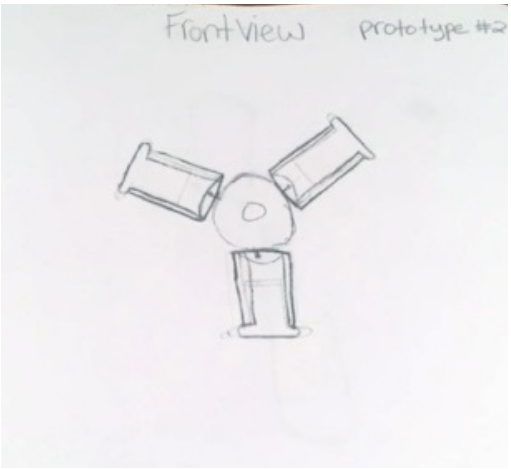
Materials-
- 3 Regular Size Red Solo Cups
- 3 Skewers
- Tinker Toy (3 Holes)
- Bottle Cap
- Hot Glue Gun

Build Process-
1. We cut the bottom of the red solo cups off.
2. Then we cut the red solo cups so that they were wider at the top than at the bottom. The blades were curved just enough to not catch the wind so it can't move but curved enough so it will produce more wind than if it was flatter.
3. We glued the skewers into the holes in the tinker toy.
4. We glued the blades to the skewers in a counterclockwise direction at an angle where the wind will go in one blade and be transferred from blade to blade.

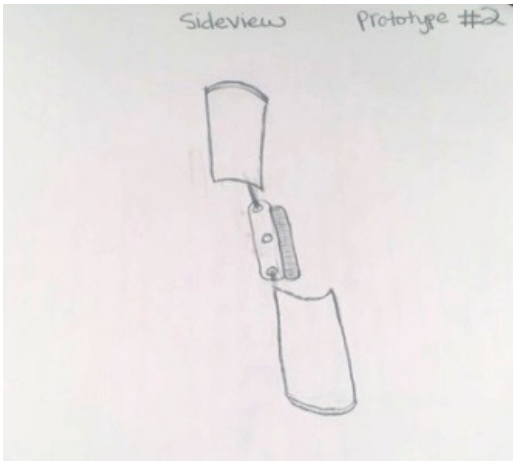
Blade Description (Artistic Design Elements AND Dimensioned Diagrams):
The blades in this turbine were made out regular size red solo cups. We cut the red solo cups into curved shapes. We cut the cup at an angle where the

shape was wider at the top and smaller at the bottom. We cut the blades this way because we believe that this shape would produce more wind than it would if both the bottom and the top of the cup had the same width. We glued the blades on at an angle where the blades were aimed at the blade in front of them. The blades were glued to aim in a counterclockwise direction.

Scale Drawings of Design 2

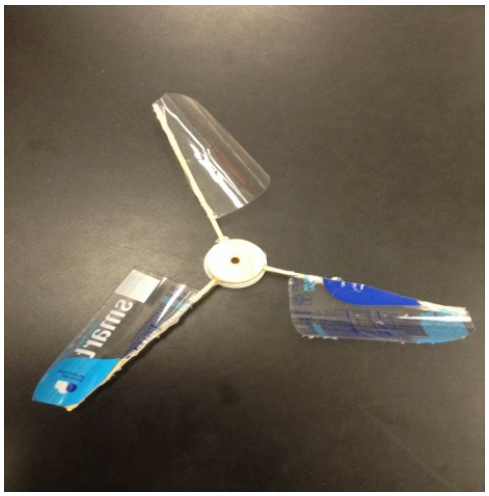


Front View



Side View

Prototype #3:



Prototype 3 Design

Design Goal:
With our third design, our goal was to make a turbine that had a greater wind speed than our first turbine. However, we had the same goal for our second turbine so our team brainstormed some ways that we could improve the design of our second turbine in order to exceed the goal for this prototype after failing to exceed the same goal for the previous turbine.

Why We Chose These Materials-
We chose these materials because this design is a combination of our first two trials. Our first trial had good speed and our second trial had good velocity. The “Smart Water” bottles are thick enough so that the turbine blades will not be flimsy but they are also flexible enough so that we can shape them a certain way.

Why We Chose This Blade Design-
We chose this blade design because we cut the turbine blades so they were wider at the bottom than at the top. They are also curved so that the wind catches in them at a certain angle. The blades are arranged on the skewers a certain way so that they are aimed where the wind will catch in each blade and be transferred to the next blade. We chose to have three blades for this turbine because we felt three was a good number of blades for the turbine in order to exceed the design goal for this prototype. Also, we felt that three blades worked very well in our first two prototypes so we wanted to stay with the same blade number.

Design and Build Process:
Materials-

- 3 Regular Size “Smart Water” Bottles
- 3 Skewers
- Tinker Toy (3 Holes)
- Bottle Cap
- Hot Glue Gun

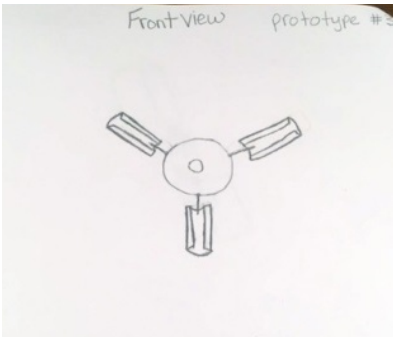
Build Process-

1. We cut the top and the bottom off of the “Smart Water” bottles.
2. Then, we cut the blades so that they had just enough curve to them.
3. We cut the blades so that it was wider at the bottom than at the top.

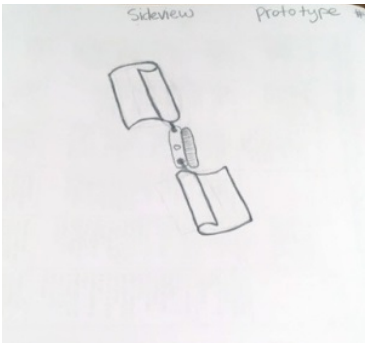
4. We cut the left side of each blade shorter than the other side so that the wind would not get caught in the blade.
5. We glued the skewers into the holes into the tinker toy.
6. We glued the blades on the skewers at a certain angle where the wind will transfer from one blade to another in a counterclockwise direction without the wind being caught in the blades.

Blade Description (Artistic Design Elements AND Dimensioned Diagrams):
The blades in this turbine were made out of small “Smart Water” bottles. We cut the bottles so the bottom is wider than the top of the bottle. We cut the bottles this way because we believe that it would produce more wind speed. We glued the bottles so the left side of the bottle was glued to the skewers. We also glued the pieces in a counterclockwise direction. We did this so that the wind would travel from one bottle to the next and travel in a continual circle.

Scale Drawings of Design 2



Front View



Side View

Data Table:

	Wind Speed (m/s)	Voltage (v)	Current (mA)	Current (A)	Power (W)
Prototype 1:	5.3	1.11	0.5	0.0005	0.000555
	5.1	1.21	0.55	0.00055	0.00068
	5	1.25	0.6	0.0006	0.00075
Average for	5.07	1.19	0.55	0.00055	0.00066167

Design #1:					
Prototype 2:	5.5	0.55	0	0	0
	6.3	0.73	0	0	0
	6.3	0.7	0	0	0
Average for Design #2:	6.03	0.66	0	0	0
Prototype 3:	5.9	0.51	0	0	0
	5.9	0.5	0	0	0
	5.3	0.53	0	0	0
Average for Design #3:	5.7	0.73	0	0	0
Average for Final Design Tests:	**5.96**	**1.51**	**1.5**	**.0015**	**.002265**

Average Power Produced By Each Turbine:

Prototype 1: 0.00066167w
Prototype 2: 0
Prototype 3 0
As you can see, prototype 1 produced the most power. Prototype 2 and prototype 3 both produced an average power of 0. This means that prototype 1 was the better design out of the three.

Overall:

Energy Transfers and Conversions:
First, the wind, which is thermal energy, pushes the blades of the turbine, which is mechanical energy. Then the blades of the turbine will send that mechanical energy to the axle, which is mechanical, and to the gearbox, which is also mechanical energy. Then that mechanical energy will go to the generator, which then become electrical energy which will then make the turbine spin.

Effect of Varying at Least 1 Variable:

Number of Blades~ The more blades, the more wind that is distributed and the greater is the force. Our prototypes all had 3 blades and we found that was a good number of blades.

Blade Length~ Longer blades move faster than shorter blades because more air is exposed to them. Therefore the faster the blades would go.

Width~ From our prototypes, the greater width moved faster than the smaller widths because more air was put upon the blades.

Curvature~ The more curve in the blades, the faster they would go because it causes the blades to travel with the air that is passing through.

Conclusion (Output Power, Efficiency, and Aesthetic Appeal):

Output Power- First you convert milliamps to amps then you multiply the number of amps by the voltage to get the power of the turbine.

Efficiency- With an efficiency of 0.786% you would need 666,667 turbines to power a house for 24 hours.

Aesthetic Appeal- Our final design was the CD case design. Our final design looks like circular fan blades that are rainbow colors with glitter. We chose this prototype to be our final design because it produced better data than the other prototypes that we made. The blades are about 4.75 inches in diameter.

Sources:

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>.