

Team Name: From Groceries to Garbage to Generator

Team Members: Angelina, Claudia, and Molly (12th Grade)

Teacher: Ms. Nuñez (mnunez@ursulineacademy.org)

Team Bio: We are Claudia, Angelina, and Molly who are seniors at Ursuline Academy in Cincinnati, Ohio USA. In an effort to keep our turbine lightweight yet sturdy enough to capture the wind, we had the idea of using grocery bags. We had all seen how the wind catches grocery bags and causes them to “fly.” Similarly, it was eco-efficient to reuse these bags as we have seen them flying around in nature where they don’t belong. The plastic bags “Drifting through the wind” reminded us of the opening to Katy Perry’s song “Firework” which is what also helped inspired our design.

Greatest Potential Energy: -0.5058 V

When brainstorming ideas for creating a wind turbine to maximize power efficiency, there were many factors contributing to what eventually became the final design. Through research of effective wind turbines, we decided that three blades would be most beneficial for our design. Similarly, research told us that shaping the blades like airfoils would help to catch more air. We tried to do this by slightly bending a heavy-duty, yet thin, wire so there could be a pocket which caught air and aided the turbine in spinning. Through research we also learned that we should try to make our blades as long as possible so that they could catch as much wind as possible. However, we had to take into account our stand height so that the blades did not hit the base of the stand while they were spinning. We decided to make our wind turbine using plastic grocery bags because we had excess of them and they are reusable, pliable, catch air easily, and lightweight. Additionally, because our design is primarily made of plastic grocery bags and wire, it is recyclable. Similarly, the design can be taken apart after the competition. The metal wire is reusable, but the plastic bag and tape are not because they would rip.

However, no design is perfect on its first try, and while this design had its fair share of complications, each one was faced head on and resolved. To start, the original blades were too long and were hitting the stand, so we bent the wire to make them a little wider rather than longer. We also placed the dowel rods higher up on the blades to shorten the distance between the stand and the blades. Next, we

found that the backs of our blades kept hitting the stand, so instead of placing the dowel rods on the front side of our blades, we placed them on the backs. Finally, we had to replace some of the dowel rods because they were starting to get worn at the bottom, which caused them to become looser and to twist while in the wind turbine. This caused the blades to turn at different angles and hit the stand. We also decided that once we place the dowel rods into the stand, we should not twist the rods while they are tightened into the stand to prevent the dowel rods from becoming loose again.

What is the primary source of energy in the US? In our region? How much does it cost to power your house each month? How much of the energy used in the US is powered by wind? How has this changed over the past 10 years?

In the USA the primary source of energy comes from turbines that are powered by wind to create mechanical energy that is later converted to electrical energy, or natural resources that create heat and steam to power the turbines. In Ohio, the primary sources of electricity are coal (47.39%) and natural gases (34.4%) with wind only making up 1.43% of electricity sources. However, the state with the greatest percentage of wind sources is Kansas with a 36.42%, and the state with the greatest amount of wind energy production is Texas. Throughout the whole nation, only about 6.6% of the electricity sources come from wind. However, this number is an improvement from past years, with the reported wind capacity in 2018 being double that of 2010. Additionally, the numbers are expected to continue improving. In 2008, the Department of Energy released their goal of 20% wind energy by 2030. In 2017, about 867 kilowatt-hours were used per month in the average American home, which is about \$112.71 to power the average American house per month.

What causes wind? What are the windiest parts of the US? Where are most of the wind turbines located in the US? Are there any offshore wind farms?

Wind is present where there is a difference in air pressure in the atmosphere because the wind is the air moving from an area of high pressure to an area of lower pressure. Texas holds almost 25% of all

the wind capacity in the United States; Texas alone ranks 5th in the world for wind capacity. Similarly, Texas leads the USA in investment in wind energy. The windiest states in the country are mostly part of the plains and include, Nebraska, Kansas, and the Dakotas. Offshore wind farms are built in the water off the coast of major costal load centers. Because the wind tends to be stronger on the coast of the large bodies, these turbines catch more wind and produce more energy. These farms are also benefitable for they are not as confined to smaller areas of land. The Block Island Wind Farm was America's first offshore wind farm built in Rhode Island by Deepwater Wind.

Works Cited

- 17, Apr. "U.S. Wind Power Grows a Record 8% in 2018." *Transmission & Distribution World*, 17 Apr. 2019, www.tdworld.com/renewables/us-wind-power-grows-record-8-2018.
- "American Wind Power and AWEA Grow by Leaps and Bounds." *AWEA*, www.awea.org/wind-101/history-of-wind/2000s.
- "Electricity Production and Distribution." *Alternative Fuels Data Center: Electricity Production and Distribution*, afdc.energy.gov/fuels/electricity_production.html.
- Mucha, Mateusz. "Electricity Cost Calculator (Single Usage)." *Omni*, Omni Calculator, 14 May 2019, www.omnicalculator.com/everyday-life/electricity-cost-single-usage.
- "Offshore Wind." *AWEA*, www.awea.org/policy-and-issues/u-s-offshore-wind.
- "Renewable Energy on the Outer Continental Shelf." *Bureau of Ocean Energy Management*, www.boem.gov/Renewable-Energy-Program-Overview/.
- "States With The Most & Least Wind." *Beef2Live*, beef2live.com/story-states-least-wind-0-122176.
- Ward, Dennis. "What Is Wind?" *UCAR*, eo.ucar.edu/basics/wx_2_c.html.