Is A Windmill A Viable Option Based on Collection of Data Taken

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1 Abstract:
Our goal for this project was to test to see which renewable energies would be suitable for our environment. Because we have all three fossil fuels located near us, we felt the need to find some sort of renewable energy that would work. After doing some research we came to the conclusion that wind energy would be the best for our environment. To test if wind turbines would actually work, we created our own small scale turbines. We had to test our average wind speeds near us to see if they would work, or if they wouldn't. After finding this data, we had to test our turbines on their own. We did this by putting each turbine through three different trials with different wind speeds. After finding which designs worked well and didn't, we calculated what the data would look like outside. The data we found was very positive and we figure that we would be able to produce a solid amount of power with the smaller turbines. With the small scale turbines looking successful, we could infer that larger turbines would be great for our environment.

Research Question and Hypothesis:
In a world where humans are on the constant hunt for a reliable and renewable source of clean energy, we investigated the use of wind energy and its potential for implementation. With the use of fossil fuels defiling our environment any renewable source of energy that is cost-efficient, is a goldmine for future energy production. In our case, this source of energy comes from the wind. With high installation cost of other forms of renewable energy, such as solar, it isn't the most cost effective form or convenient form of clean energy. With this in mind, we are left to ask ourselves, is wind energy a viable alternative to fossil fuels?

Introduction and Review of Literature:
With the constant threat of fossil fuels polluting our environment, we made it our mission to see if renewable energy is viable for our community. Through various programs such as KidWind and PowerGrid Partners, we created our own means of wind energy production and collected data of our own naturally occurring wind. The purpose of this project was for us to see if wind energy is the future for our community. We live in an area where all 3 of the major fossil fuels are either refined or processed for our energy. In order to combat this we want to see if wind turbines, like the one at our high school, can provide our entire community with renewable energy. At our high school (Clay High School) we are powered by what we hope is the future in renewable energy, which is of course a wind turbine. Through a company called PowerGrid partners, our school is powered by a large, singular wind turbine situated just north of our campus. This turbine is the PowerWind 900kw turbine, which is the largest turbine that PowerGrid offers. As its name suggests, this turbine has a 900 kilowatt output which makes it perfect for powering our somewhat large school (PowerGrid). So far, our turbine has given us no problems, it has provided us with clean, safe energy that powers our school. To accompany our data taken from our local park, we also constructed smaller models of our own design. Through a program known as KidWind, we were able to construct our own turbines and test their effectiveness in our simulated lab. There we were able to test the electrical output of our turbines to see if they would be effective on a larger scale. Through both of our data collection methods and analysis, we were then able to thus conclude whether or not wind energy is the future for our community.

2 Research Methods and Materials (Including GLOBE Data!):
We collected our research using the hill at a local state park. This hill sits very close to lake Erie so we felt that it would give us an accurate result of the wind speed that was coming off of the lake. We used an anemometer to gather our wind data and carry out the procedure. With this instrument calibrated in m/s we were able to use this to test the wind speeds atop the hill. The time of day was set to be a time that we could consistently reach the top of the hill. The time selected was 3 p.m. and as we collected data we consistently went at this time to keep an accurate measure of the wind data gathered. The wind was gathered 5 days a week for 2 weeks. A total of ten days of collected data in order to find an average speed that we are able to trust because of high data collection. Quantitative data was collected using the anemometer to show the wind speed for that day. The wind speed was then taken note of for that time and day, then was recorded and used in the study. We had one specific team member, who lived near the site, collect the data. He would go to the hill after school on his way home to retrieve the data. His procedure was to walk up the hill, when reached the top, hold the anemometer in the air, then record the data read on the instrument. This process was repeated throughout the project. This helped to keep the data true to what we wanted and helped to make sure the data was accurate.

Results:
Wind could possibly be the alternative energy in the future depending on how the wind or global warming could change in the coming years. Take examples of these graphs. For the first graph you would be taking the best data you have received and dividing it by the speed. For the second graph you are taking the millivolts of all 3 tests of our windmill and dividing them by the wind speed we were testing our windmills at. Then take 3 and divide it by the answer you got from the first original answer and then multiply by 4.1. That will give you the average slope of the data we have accomplished. With the data shown on the graph Melanie data has the highest set of data because her time and style of blades catch the most wind.

3 Discussion:

After three trials of gathering the speed of the homemade windmills, Melanie blades were the best. This is because the blades had less weight and were very small, which was easier to catch the wind. If the blades were bigger it wouldn't have been able to catch as much wind. Size really does matter when it comes to making a windmill that will catch and produce the most wind and energy. As a result of the hypothesis wind energy is probably not the best alternative energy source. According to ela.gov fossil fuels are at 78% and Blue creek wind farms 3%. These results also compared to the results done by the Coastal Ohio wind project which created the establishment of availability of wind turbines across the coastal and offshores religion of Northern Ohio. Possible sources of error when it comes to this project could be not enough wind in the area we place the windmill or also it could be too much wind and it causes the windmills to break.

Conclusion:

For this project we were taking the wind speeds by the lake and it seemed to me much stronger since the wind can be stronger out there. Some suggests we could have tried is maybe taking the wind speeds more in land and by the lake to compare them to each other. Implications for some of the future projects is we can use multiple areas to collect the wind speeds. Make all the wind blades all the same size to hopefully get similar data. Also there could be research on the highest wind quest by the lake compared to in land as well. For future protocols, take a longer time to gather the data of the wind speeds.

4 Bibliography/Citations:

- eia.gov
- Globe.gov
- AREOKATS
- KidWind
- powergrid.com

5 (Optional) Badge Descriptions/Justifications:

Be a Collaborator

In our report we worked as a team using different components and assigned different roles for each team member to do. Along with collaborating to collect data within our group and composing different roles of which each team member would do. We also worked with Kid Wind, to help design and test our windmills in the field.

Be a Data Scientist

While we recorded field data, we kept track of our trials in a google sheet. This is also where we kept our data from local wind speeds over a span of two weeks. We then were able to use the data that we collected to implement it to make it possible to see how our windmills would react in our local environment.

Be an Engineer

Within our tests, we each created different examples of windmills to see which design worked better. We then continued to refine and change our designs to make them function in a more economical matter. And a way in which would offer a better alternative to fossil fuels.

Be a STEM Professional

The tests that were run throughout our data collection, were spaced out over a portion of time, in which each of our team members got time to change and refine the design of their windmill to make them operate more functionally. With this we were able to better the power output and address issues such as weight that may have affected the windmill.