Humidity's Effects on The Output of a Wind Turbine
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Abstract
Using a kite and the Kestrel Weather station, data on the humidity and speed of the wind is recorded. Using the data, the correlation between the power output of the wind turbine and the humidity is stated

Center Bold Statement
The impact of humidity levels in the air on the output of a wind turbine.

Introduction
Humidity's Effects on The Efficiency of a Wind Turbine

Air density and energy generation efficiency are impacted by humidity, which is an important factor in wind turbine performance. Sometimes scientist need to measure the humidity, as stated by David Schecter, writing for Journal of the Atmospheric Sciences “relative humidity above an area covering the central and uptilt regions of the boundary layer 43 vortex.” (3) For example, they need to measure it during hurricanes or tornadoes by finding the humidity. Enforcing this, Schecter states “relative humidity in the core of the PD vortex is moderately enhanced relative to the environment.” (Schecter 7) Optimizing wind energy output requires understanding parameters like humidity, which is crucial as renewable energy sources develop. In a society that is increasingly getting more energy-focused, this study explores the effects of changing humidity levels on wind turbine efficiency, providing insight into what can be enhanced in design and operating techniques.

Hypothesis

It was believed increased humidity reduces the output of wind turbines by affecting air density and drag on the blades, leading to decreased aerodynamic performance and lower energy output.

Objective

The purpose of the research is to investigate how varying levels of humidity influence the efficiency of wind turbines.

Methods

- Use Go Direct weather stations to measure humidity levels and assess their effect on the turbine power efficiency.
- Gather the kite and Kestrel Weather Station.
- Use the Kestrel Weather Station to measure from the ground then fly the kite and attach the Kestrel at the required height.
- Collect and share data with one another to analyze and create graphs, ensuring a clear visualization of the results.
- Put the data in the GLOBE website and use stats website for graphs.
- Safety is a top priority throughout the process, use personal protective equipment including gloves when handling equipment, flying kites, and collecting data outdoors.

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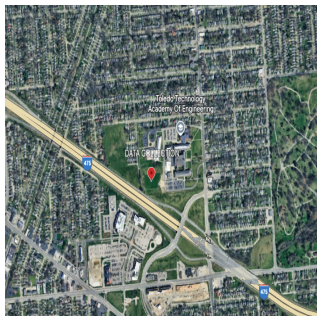
Results

It was believed that the humidity would lower wind energy levels. The results indicated that humidity has a minimal effect on the output of wind turbines. Variations in atmospheric moisture levels did not significantly impact the output or efficiency of the turbines. Overall, humidity isn't a major factor in how well wind turbines produce energy.

Graphs/Photos/Maps

Taking ground data

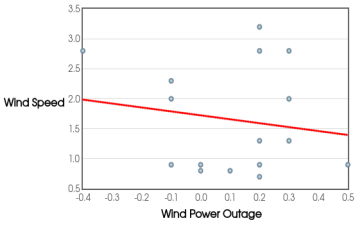
Flying the kite

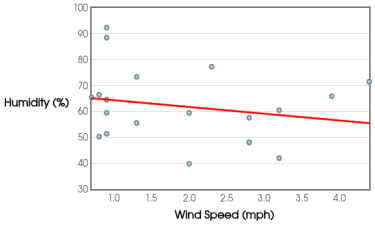


Overhead view of neighborhood

	Date	Time	Location	Initials of Collect	Wind Turbine Power Output	Humidity (%)	Wind Speed(mph)	Additional Notes	Observations
2	10/7/2024	10:30-10:40	EV lab field	A A E	Power: 0.5 mW	51.4	0.9	Not enough wind to fly kestrel	
3	10/8/2024	10:30-10:40	EV lab field	A A E	Power: 0 mW	50.3	0.8	Not enough wind to fly kestrel	
4	10/9/2024	8:56-9:06	EV lab field	A A E	Power: 0.1 mW	66.5	0.8	Not enough wind to fly kestrel	
5	10/15/2024	10:00-10:40	EV lab field	A A E	Power: 0.2 mW	42	3.2	Kite crashed into tree	Wind speed measurement may be incorrect
6	10/16/2024	10:00-10:40	EV lab field	A A E	Power: 0.2 mW	57.6	2.8	Not enough team members to fly kite	
7	10/17/2024	10:00-10:25	EV lab field	A A E	Power: 0.5 mW	N/A	N/A	Not enough wind to fly kestrel	Kestrel did not send data
8	10/18/2024	10:30-10:40	EV lab field	A A E	Power: 0.2 mW	65.4	0.7	Not enough wind to fly kestrel	
9	10/21/2024	10:30-10:40	EV lab field	A A E	Power: 0.4 mW	48.1	2.8	Not enough wind to fly kestrel	
10	10/23/2024	10:30-10:40	EV lab field	A A E	Power: 0.3 mW	48.1	2.8	Not enough wind to fly kestrel	
11	10/24/2024	10:30-10:40	EV lab field	A A E	Power: 0.2 mW	55.6	1.3	Not enough wind to fly kestrel	
12	10/25/2024	10:30-10:40	EV lab field	A A E	Power: 0.0 mW	92.4	0.9	Not enough wind to fly kestrel	
13	10/28/2024	10:30-10:40	EV lab field	A A E	Power: 0.1 mW	39.8	2	Not enough wind to fly kestrel	
14	10/30/2024	10:30-10:40	EV lab field	A A E	Power: 4660.5 mW	65.9	3.9	Flew the kestrel	
15	10/31/2024	10:30-10:40	EV lab field	A A E	Power: N/A	71.5	4.4	Too much wind to fly kestrel	Wind turbine did not cooperate
16	11/1/2024	10:30-10:40	EV lab field	A A E	Power: N/A	59.5	0.9	Not enough wind to fly kestrel	Oxygen
17	11/4/2024	10:30-10:40	EV lab field	A A E	Power: N/A	60.5	3.2	Flew the kestrel	Oxygen
18	11/6/2024	10:00-10:10	EV lab field	A A E	Power: 0.1 mW	77.3	2.3	Not enough wind to fly kestrel	
19	11/12/24	9:58-10:08	EV lab field	A A E	Power: 0.1 mW	64.6	0.9	Not enough wind to fly kestrel	
20	11/13/2024	10:00-10:10	EV lab field	A A E	Power: 0.3 mW	59.5	2	Flew the kestrel	
21	11/14/2024	10:30-10:40	EV lab field	A A E	Power: 0.2 mW	88.5	0.9	Not enough wind to fly kestrel	
22	11/15/2024	10:30-10:40	EV lab field	A A E	Power: 0.3 mW	73.4	1.3	Not enough wind to fly kestrel	

All of our data





Conclusion

The hypothesis included humidity making a significant difference in lowering the wind speed. It was hypothesized that high humidity would equal low wind speeds and low humidity would equal high wind speeds. After collecting data, it was concluded that humidity does not have a significant impact on the speeds of wind. After using all of the methods for finding data, it was concluded that there would be no correlation between the humidity and wind speed after all. If there were more time, changing methods and the measurements used would get different results to have more correlation in the data. Understanding humidity patterns empowers us to build a more resilient and sustainable future

Badges

I AM A DATA SCIENTIST:
We collected a multitude of data relating to the humidity and speed of the wind.
I AM A PROBLEM SOLVER:
We are problem solvers by seeking a solution when we lost our TERA flyer kite and needed to build a replacement kite to continue collecting our data.

Acknowledgements
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References
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