Clouds vs. Solar and Wind Energy

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Abstract:

Solar and wind are two well-known sources of renewable energy. Appearing in Future Internet and writing "Harnessing the Cloud: A Novel Approach to Smart Solar Plant Monitoring," M. I. Ali et al. argue, "renewable energy sources (RESs) such as solar, wind, hydro, and biomass are emerging as optimum solutions for sustainable energy generation." Both of them have downsides and things that negatively impact them. Comparing the outputs of solar and wind energy compared the cloud coverage; this research was conducted to see how both would be affected. Going off the gathered results, it was found that clouds affect solar energy output more than wind energy output. While, solar energy still produced more overall power.

Clouds have an effect on solar energy output, and potentially wind. Through data collection, it was discovered that Clouds affect Solar Energy Output more than Wind energy output.

Introduction:

Solar power and wind energy are some of the most well-known forms of renewable energy. Solar energy is harnessed through photovoltaic cells within solar panels, and wind energy is harnessed using the rotational power of the blades on wind turbines. In an elementary grade science project, it was learned solar will consistently make much more energy as opposed to wind. Something important to understand is the Betz Limit, a theoretical mathematical limit to the energy efficiency of a wind turbine, said efficiency being 59%. So, a hypothesis was formed and predictions for data results were made. Writing for Energies, J. S. dos Reis et al., in "Wind and Solar Energy Generation Potential Features in the Extreme Northern Amazon Using Reanalysis Data," explains, "Wind and solar energy are two of the most important renewable energy sources in the world today." So, performing a research project that harnesses these forms of power is bound to yield fascinating results. Clouds are prevalent everywhere, every day, affecting renewable energy supplies. And in Toledo, there is a mix of cloud cover and sun in a year. Also, local topography is relatively flat and spread out. Therefore, the question was asked: What's affected by clouds more, solar or wind? "the research work…is based on the use of qualitative research methods…based on the fact that qualitative research does not seek to obtain generic information," as written by Vatuiu and Lazaroiu in Using Renewable Energy Sources in the Context of Promoting a Conceptual Model for Sustainable Cloud Computing.

Hypothesis:

It was believed cloud coverage will negatively affect solar energy output more than wind; however, solar will still end up producing more energy than wind. This is believed because cloud coverage typically doesn't affect wind energy that greatly, at least to common knowledge.

Objective:

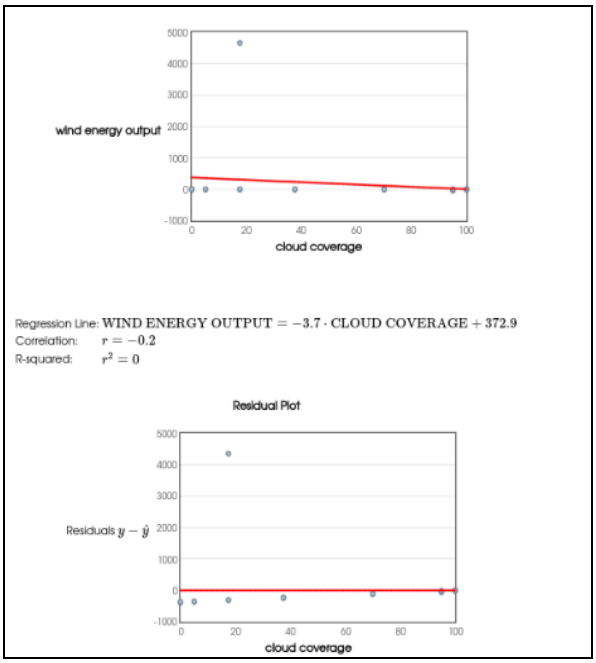
It is commonly known that clouds covering up solar panels will reduce the energy output of those panels; although, will cloud coverage have an effect on the output of wind energy? If that is the case, it's still unknown if solar panels will still produce more energy.

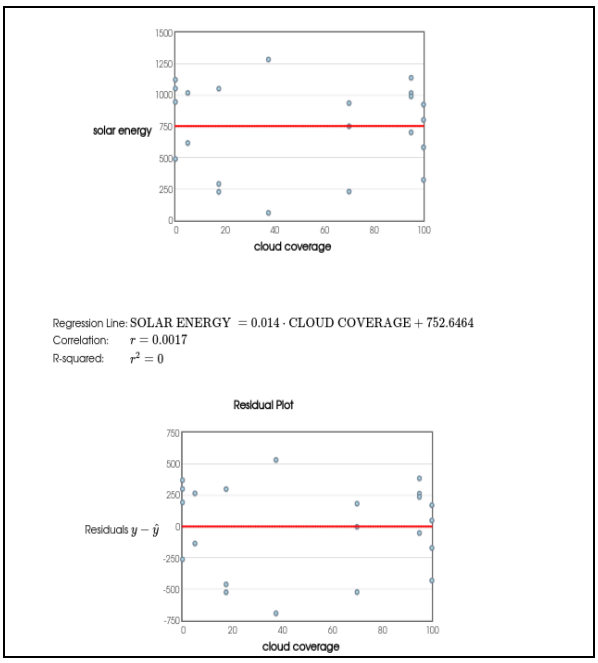
Methods:

First, collect materials such as a Labquest 2 or 3, iPad–with the GLOBE app installed. Second, find and choose a location for where data will be collected. Third, in order to find a location, choose a location that has good clearance of the sky and good wind direction/speed. Fourth, learn how to use your data-collecting instruments and work. Fifth, run a test to see if your location will work well for collecting data. Sixth, choose the frequency at which you'll collect data. Seventh, use materials such as an Anemometer, APsystemsema website, LabQuest 2, and iPad to collect data on the wind, clouds, and solar energy output. Eighth, record data on the GLOBE website after each session of data collection. Finally, take compiled data, and on the stats.blue website, create a graph for your data.

Results:

Through–near–daily data collection, the task was to discover a correlation between the amount of clouds covering the sky, the output of both solar panels and a wind turbine, and which form of energy produced more power. Correlating to the hypothesis, the data proved solar power will be far more productive than wind energy, even when solar energy's output was being negatively affected by cloud coverage. Discovered through the data points, cloud coverage has far less of an impact for solar output than expected, while there was still much more of an impact for wind than expected. Despite clouds entirely covering the sky several times, the ability of the wind turbine to produce a measurable amount of energy was far too inconsistent to be greater than the comparative output of the solar panels. This was most likely caused by the small size of the wind turbine causing it to struggle when catching the wind. Although something to acknowledge is, every machine used to harness renewable energy will have varying levels of efficiency, based on design, size, location, and many other factors. While renewable energy is currently greatly unreliable, depending on outside factors which cannot be controlled, scientists, researchers, and engineers are working to develop new technology to acquire energy more efficiently and reliably.





Conclusions:

In the Toledo, Ohio, city area specifically, solar was found to be affected more than wind when it came to the effect of clouds. Additionally, solar energy continually produces more energy than wind, as expected. Considering the ups and downs of renewable energy–not to mention the Betz Limit, limiting the theoretical maximum efficiency of wind turbines at 59%--it is best to conduct studies to find what energy form works best for which application and location. If more time was allowed, additional things, such as measuring at additional times of the day to gather more data points, would have been measured. Also, potentially try using the wind turbine in different locations and collecting more data through the APsystemsema website. Message of Hope: While renewable energy is currently greatly unreliable, depending on outside factors that cannot be controlled, scientists, researchers, and engineers are working to develop new technology to acquire it more efficiently and reliably.

Badges:

I am a Data Scientist - We believe we're worthy of this badge because we collected nearly six weeks worth of data points. With all these data points, we deeply analyzed them in order to figure out the correlations between our hypothesis and results. Thanks to our analysis, we were able to answer the questions we posed to ourselves.

I Make an Impact - When reviewing our data and poster, we added mentions to our location and regional geography. We mentioned these things to better explain many of our results and why our readings were what they were.

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