Analyzing the Impacts of Wildfires on Solar Photovoltaic Generation

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Introduction

- Climate change is causing wildfires to be more frequent and intense
- Fires eject particulate matter (PM) into the air
- Previous studies show that concentrations of ~75 ug/m³ of PM2.5 decrease photovoltaic (PV) generation by ~20%
- An understanding of this relationship is vital to illuminate future trends in energy

Example of a previous study performed by the EIA in California

Objective

Quantify the effect of out-of-state wildfires in 2021 on PV generation in Golden, CO

Air Quality Maps

August 6, 2021

August 7, 2021

Methodology

- Data Analysis
  - Obtain data
  - MATLAB Framework converts data to workable format
  - Create a MATLAB plot to display correlation

Data Sources

- Daily CA/CO solar generation and California peak air particulate matter (PM2.5) level (micrograms per cubic meter)
- August Complex fire starts August 16
- Creek Fire starts August 15
- North Complex fire starts August 18
- 5/1-9/30/2021 PV Data from NREL's Garage Roof Array
- PM2.5 Data from PurpleAir Quality Sensors
- Atmospheric Data from NREL's Solar Radiation Research Laboratory

Power Generation, Particulate Matter and Cloud Cover Data

- Organized, close-up analysis of data of 47 dates centered around 7-1-2021 to show two PM2.5 spikes
- Shows average daily PV generation, average daily value of the sensor with the highest PM2.5 concentration that day, and average daily opaque cloud cover percentage

Results

- Correlation between cloud cover and power generation
- No correlation between PM2.5 and power generation

Conclusion

Summary

There may or may not be a correlation between PM2.5 and PV Generation as results undergo bias from cloud cover

Future Work

Employ analytical techniques to control for false cloud cover readings caused by high PM concentrations

References


Acknowledgements

The authors would like to thank Colorado School of Mines for providing ME&M funding, and for giving the first two authors the opportunity to work as an undergraduate researcher.