# Abstract

## Analysis of the Temperature Effects Related to Power Generation Surrounding Wind Turbine Installations Southwest of Abilene, Texas

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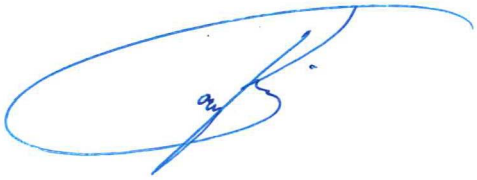
The wind farms in Texas southwest of Abilene are some of the oldest in the United States and have provided many researchers the opportunity to study the long-term effects of wind turbines on the environment. The principal objective of this thesis was to compare 2020 maximum and minimum land surface temperatures on both high and low-generation days within and adjacent to an Abilene wind farm. This work shows the impact of turbine placement on differential temperature ranges and on diurnal temperatures and temperature ranges between and within high- and low-power generation days. I used National Aeronautics and Space Administration (NASA) 1 kilometer resolution temperature data and QGIS for temperature differential, defined as the temperature difference at a specific location within a specific area compared to the same average difference for a control area outside of turbine influence. I compared temperature differentials within 1 km of wind turbines to those at 5 km or greater from the nearest turbine to define areas inside versus outside of turbine influence.

First, the LST datasets show a statistically significant *lower average temperature within wind farms* compared to the average outside the farms for the *high-generation day*. Second, the LST datasets show a small but statistically significant *higher average temperature within wind*

*farms* for low-generation day minimum temperatures. Third, there is *no* statistically significant average temperature difference between wind farms and areas outside of them when considering low-generation day maximum temperatures. The between generation days analysis reveals that the *average difference in temperatures between high- and low-generation days within the wind farms was less than this same average difference outside of the wind farms*. The high-generation day was associated with a slightly greater average range of diurnal temperature within wind farms compared to the average diurnal temperature range outside of the wind farms. The same isn't true for the low-generation day, where there was no statistically significant difference in average diurnal temperature range.

The Horse Hollow wind farm and adjacent turbines on high power generation days are associated with a noticeable land surface temperature decrease within the wind farm compared to the surrounding area.



_____November 10, 2022_____

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