



Austin Green Energy Predictor

UT-Austin Data Analytics Bootcamp, 2020
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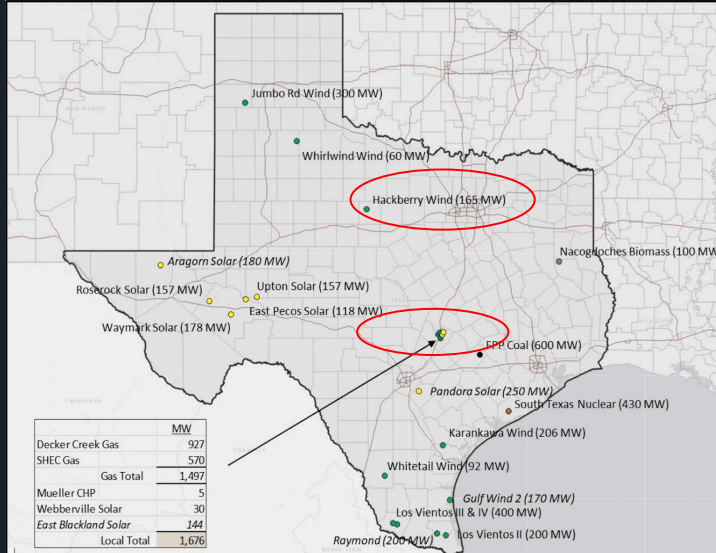


Selected Topic and Purpose

- **Objective:** Austin Energy Predictor outputs forecasted renewable energy (MWH) generated from a wind and solar energy farm in Texas.
- **Model:** Used to predict renewable energy output based on time and weather factors such as temperature, wind speed and cloud coverage.
- **Purpose:** Using data to forecast power generation to get a better understanding of renewable energy as a mainstream power source for a healthier planet.

Source Data

Energy Output (MHW) and Weather Parameters



- Flat files from Austin Energy for Hackberry Wind Farm and Webberville Solar Farm with hourly power generated for 2017 - 2020 (July)
- Hourly weather parameters such as temperature (F), wind speed (mph), and humidity (%)

Database Structure - MongoDB

Flat CSV Files:

- Store as Pandas DataFrame

Historical Energy Output (Mwh) Data (2017 - July 2020)

Historical Weather Data (2017 - July 2020)

API Call:

- Requests Library

Extract, Transform, & Load the Data

Manipulate and Join Data:

- Pandas Library

Structure Data

Formats:

- Datetime Module

Perform Operations on Data:

- NumPy Library

Database:

- MongoDB Atlas
- Connection String:
- PyMongo

Database

Exploratory Analysis

Plotting Libraries:

- Matplotlib
- Seaborn
- Plotly
- hvPlot

Encode & Scale Features:

- Scikit-Learn Library

Preprocessing

API Call:

- Python Requests Library

Forecasted Weather Data

ML Model Supervised/ Non binary: Neural Network, & Multi Linear Regression

Linear Regression:

- Scikit-Learn Library

Train ML Model:

- TensorFlow Library

Save and Load Scaler:

- Pickle Module

Austin Energy Predictor & Dashboard

Web Application:

- Flask App

Deploy App:

- Heroku

Visualizations:

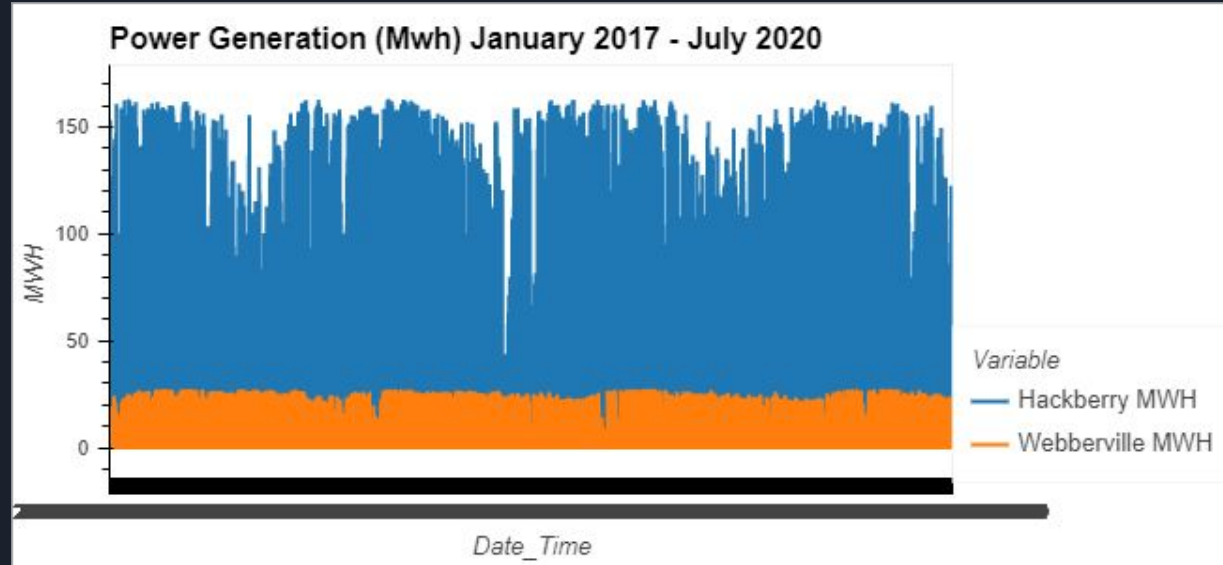
- JavaScript

Styling:

- HTML
- CSS

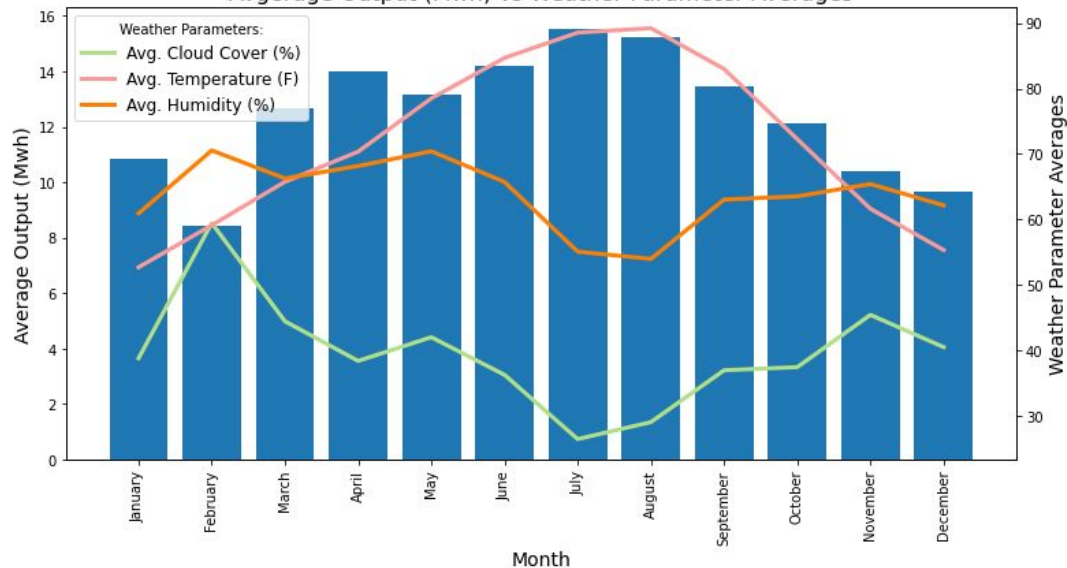
How does Weather and Time Impact Renewable Energy Output ?

- Solar energy
 - Humidity
 - Temperature
 - Sunlight
 - Time
- Wind energy
 - Wind Direction
 - Wind Speed
 - Humidity
 - Temperature

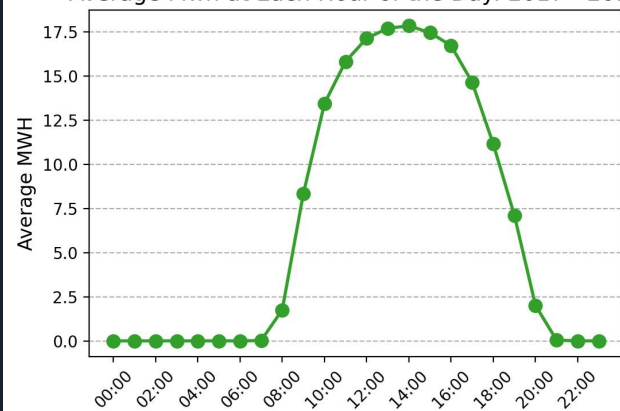


Exploratory Analysis: Solar

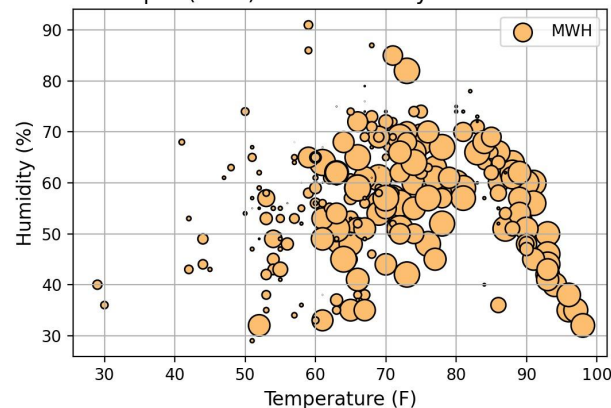
Average Output (Mwh) vs Weather Parameter Averages



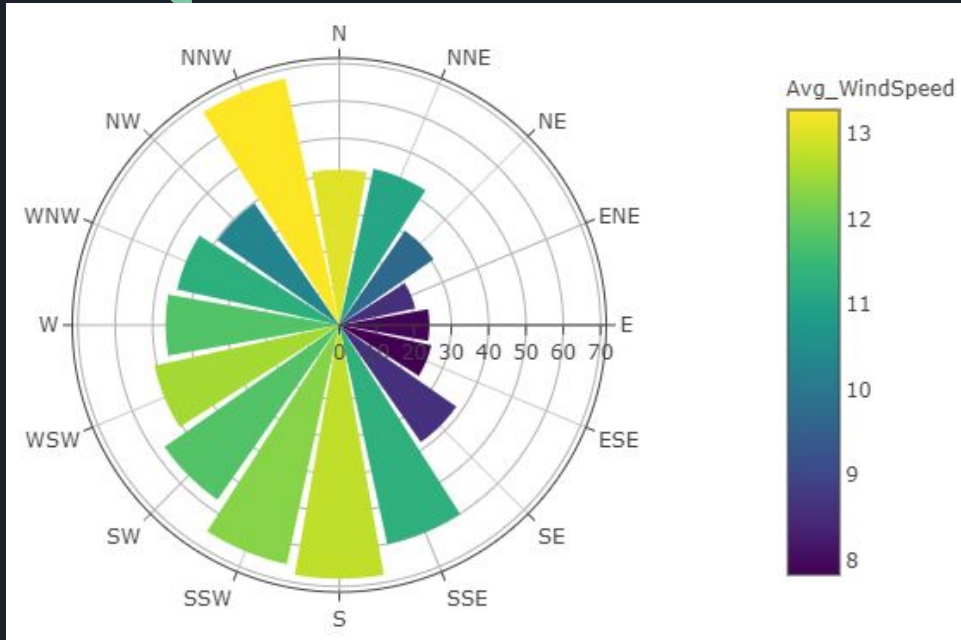
Average Mwh at Each Hour of the Day: 2017 - 2019



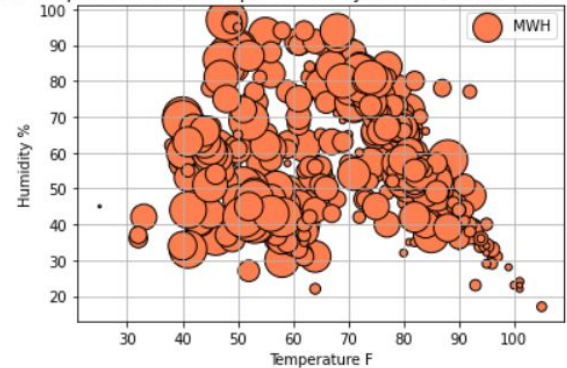
Output (Mwh) on a Clear Day: 2017 - 2019



Exploratory Analysis: Wind



Humidity and Temperature relationship to Southerly Wind Direction with Wind Speed of 9 mph



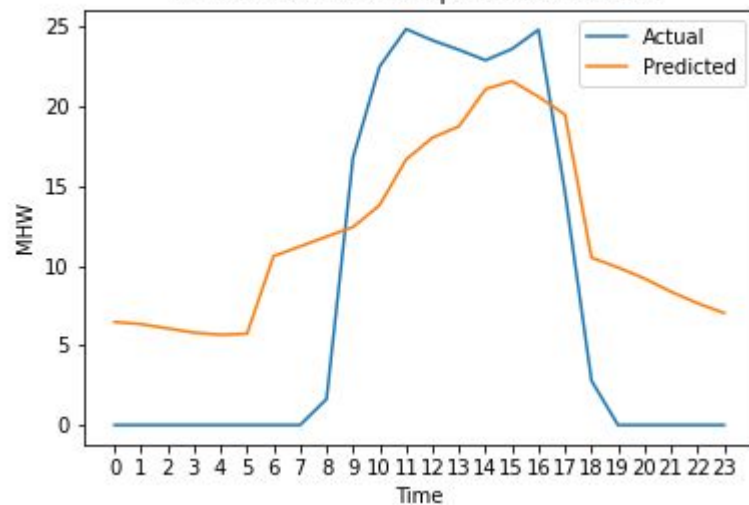


Data Analysis/ Machine Learning Model

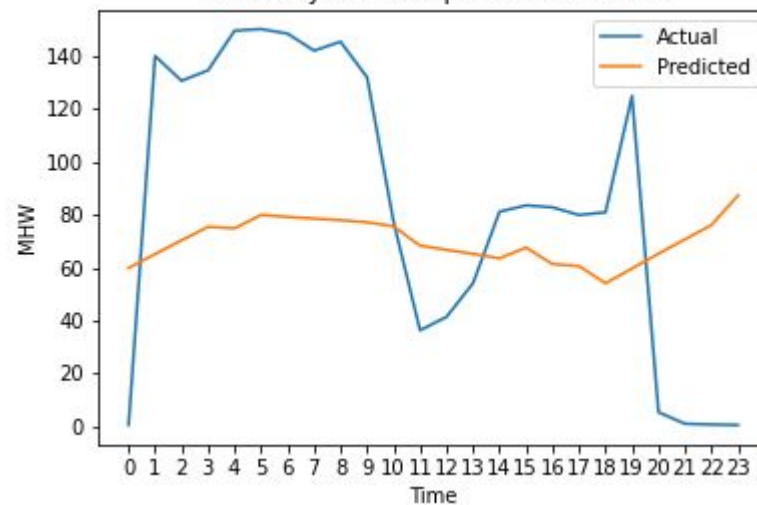
- Problem
- Type of Model Needed
- Linear Regression vs Neural Network
- Scaling Data
- Train Test Split

Linear Regression

Webberville MWH Output on 2020-02-02

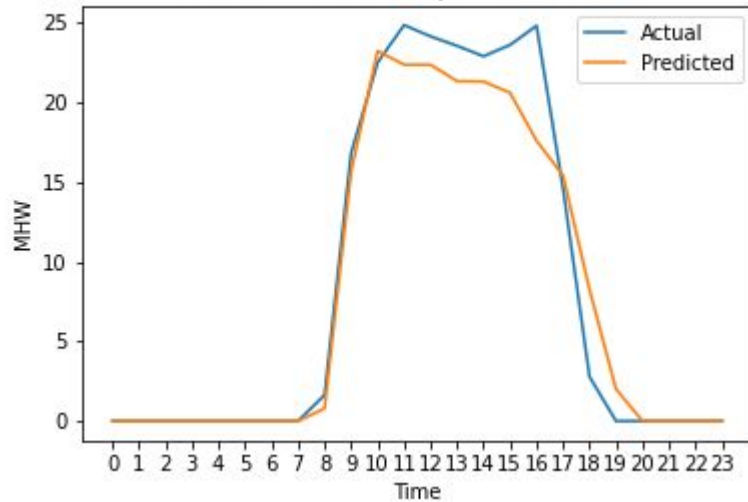


Hackberry MWH Output on 2020-02-02

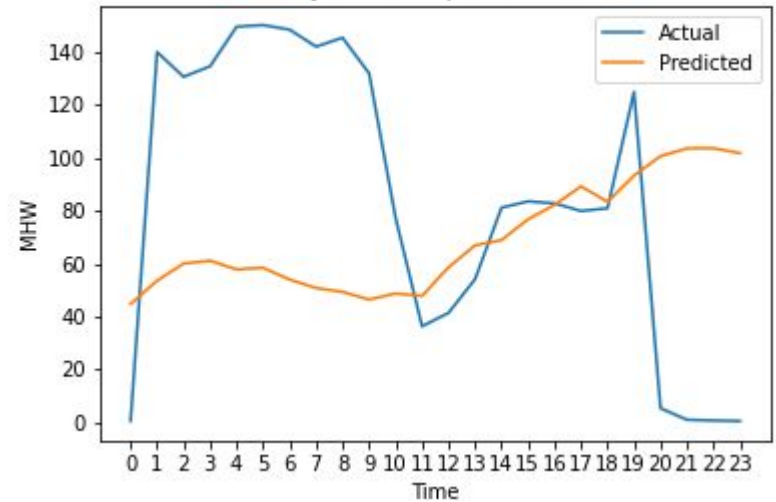


Neural Network

Webberville MWH Output on 2020-02-02

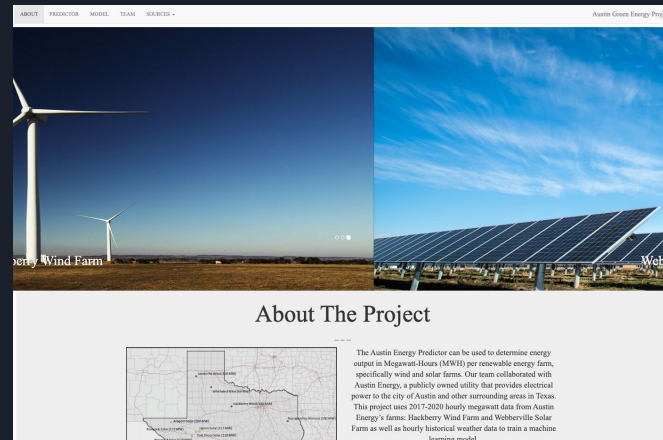


Hackberry MWH Output on 2020-02-02

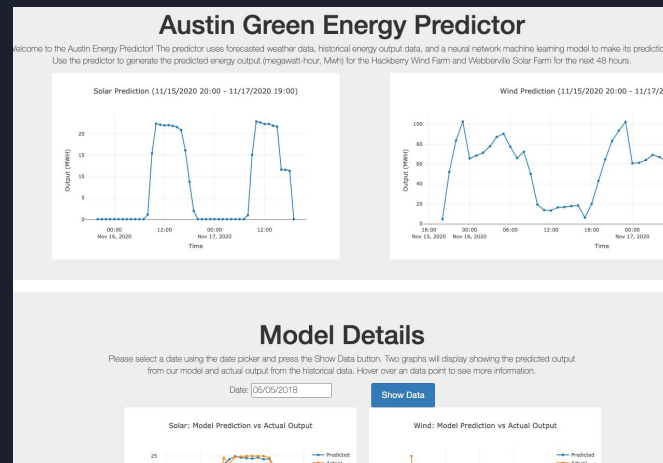


Dashboard

- Framework built with **HTML, Flask, CSS, JavaScript**
- Tested throughout development locally
- Deployed as a production ready app via Heroku
 - Allowed for secure handling of API keys, usernames, and passwords
 - Interactive elements have seamless integration into the static app content
 - Allows for future scalability



[Heroku](#) | [Dashboard App](#)



Future Analysis & Recommendations

- Incorporating other weather characteristics
- Adding more features to the model
- Developing a more advanced model for wind and solar



The Team



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