GreenSight: AI-Driven Renewable Energy Forecasting and Site Optimization

HARNESSING DATA SCIENCE FOR A SUSTAINABLE FUTURE

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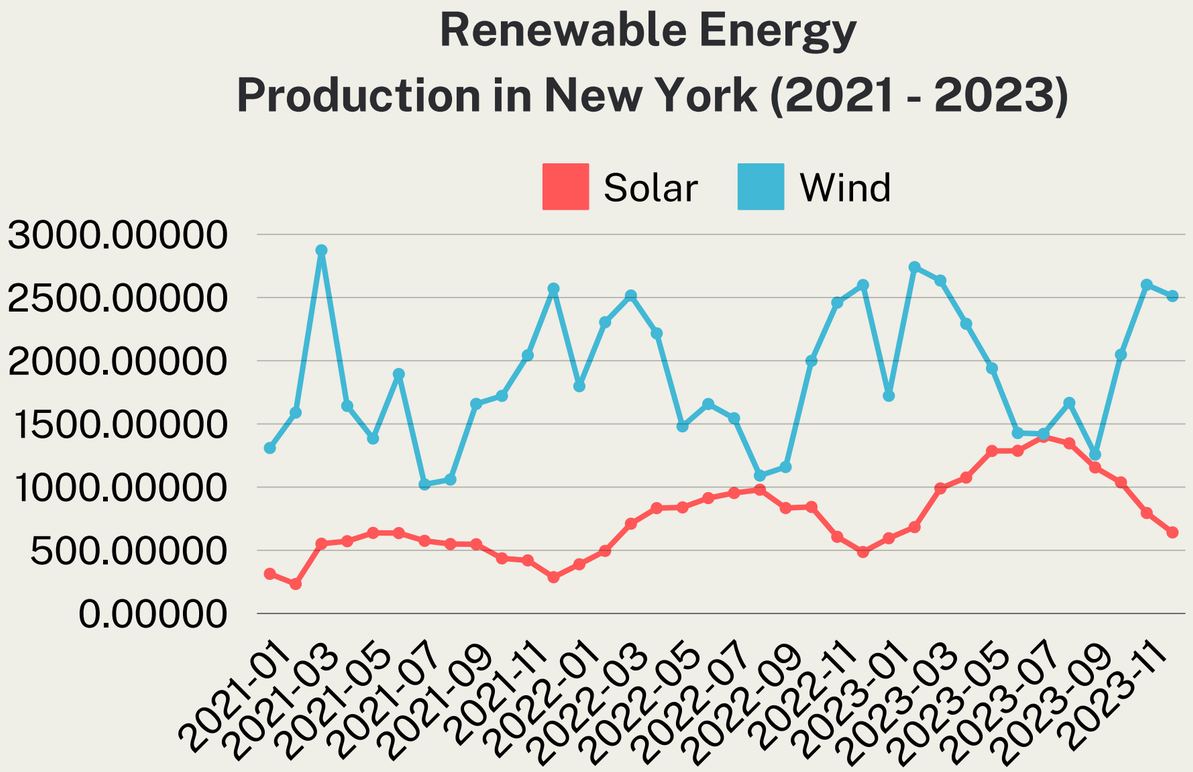
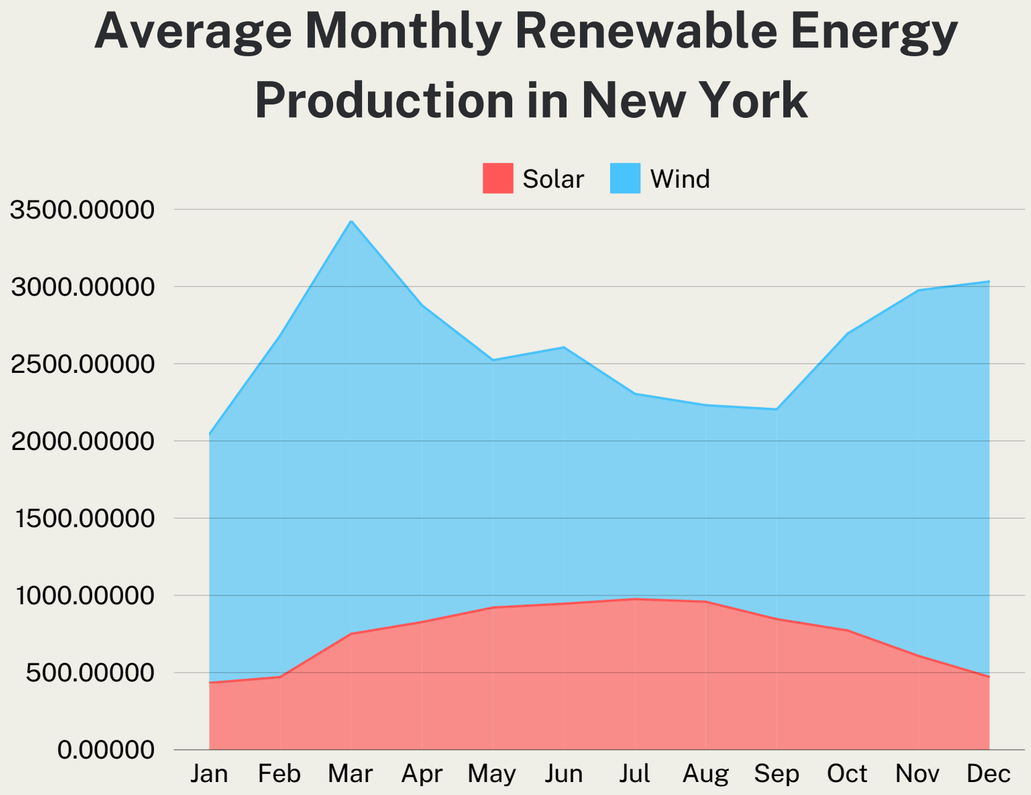
PROBLEM

- Variability of renewable energy sources
- Need for improved grid management
- Importance of optimal site selection

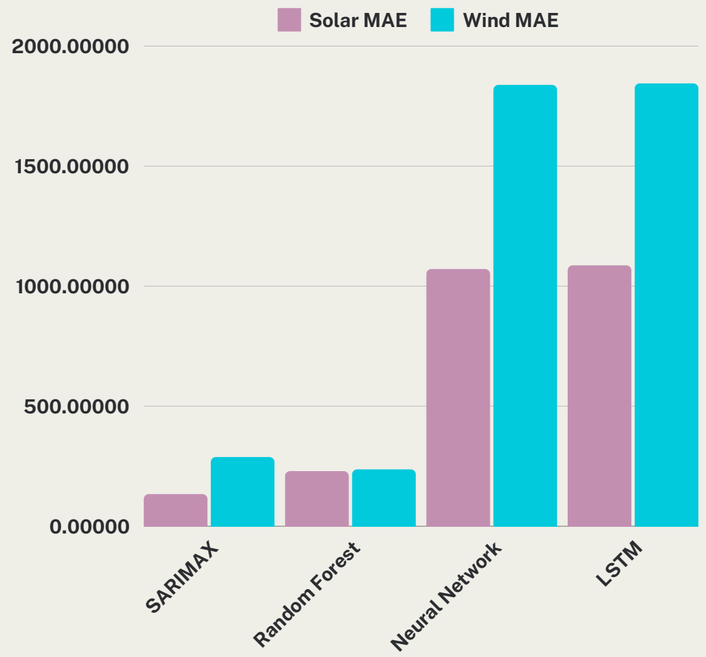




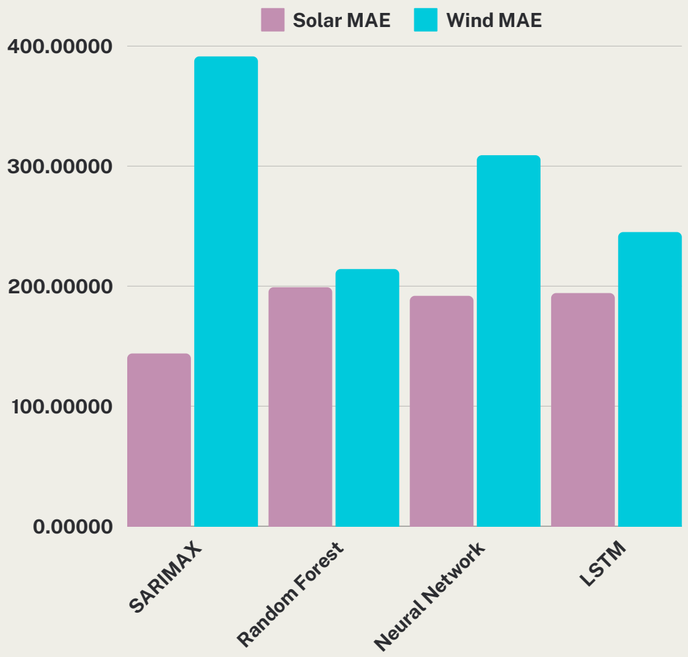
VISION AND SOLUTION

- Develop advanced forecasting models
  - SARIMAX,
  - Random Forest
  - Neural Network
  - LSTM
- Integrate geographical and weather data
- Implement AI-driven site optimization

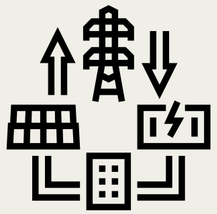
Previous



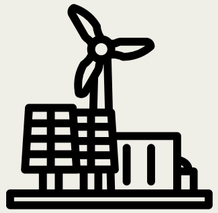
Current



POTENTIAL IMPACT



Improved grid stability



Enhanced renewable energy integration

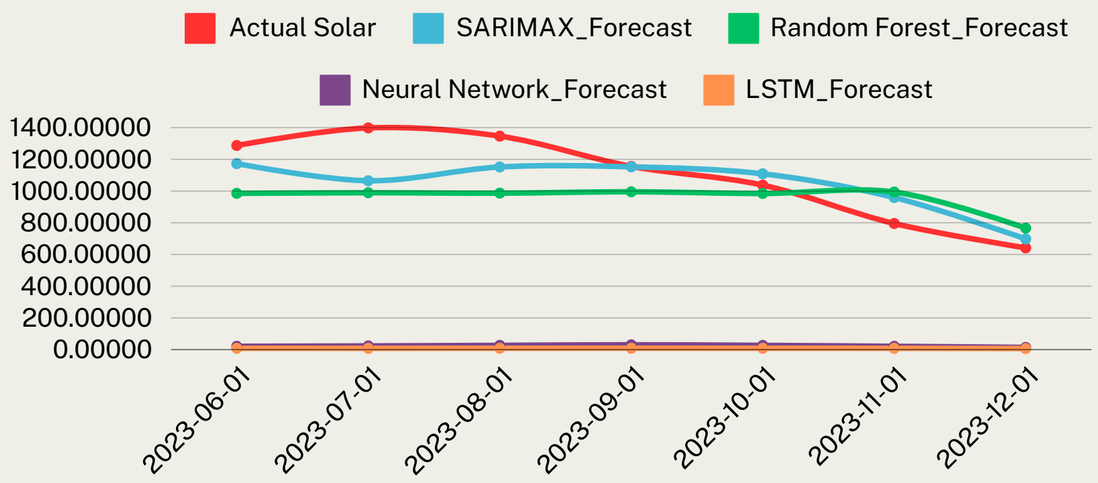
Better decision-making tools

Support for policymakers

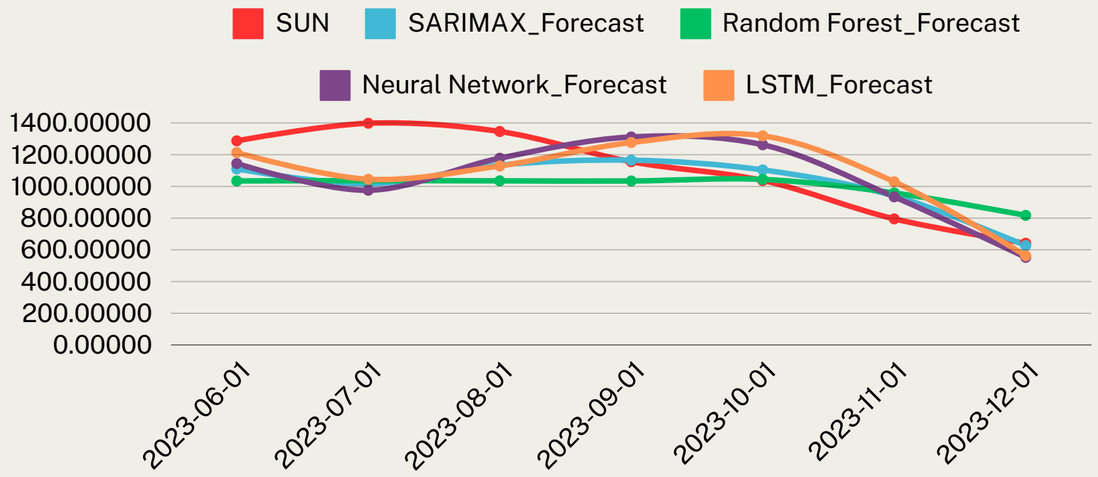
Environmental Impacts

Solar Energy Forecast

Previous

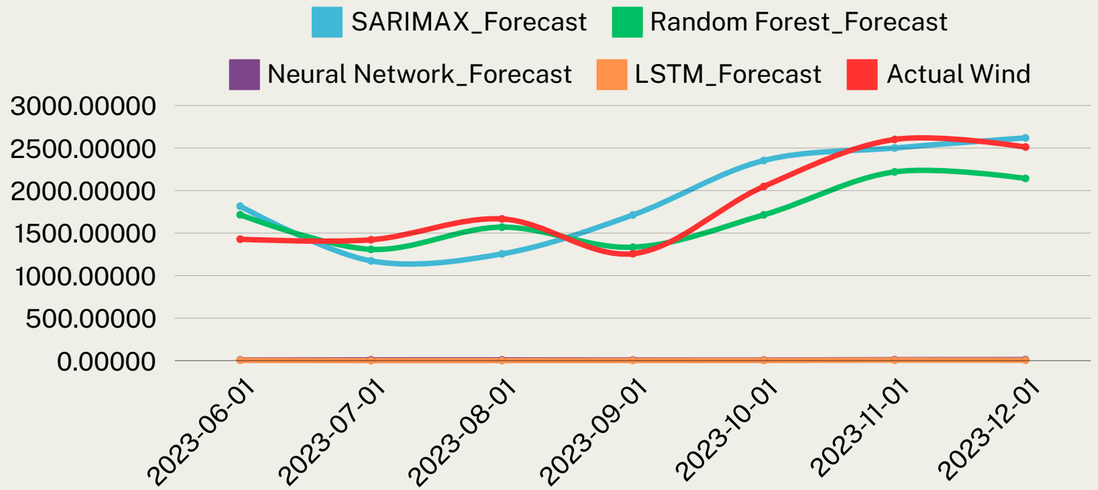


Current

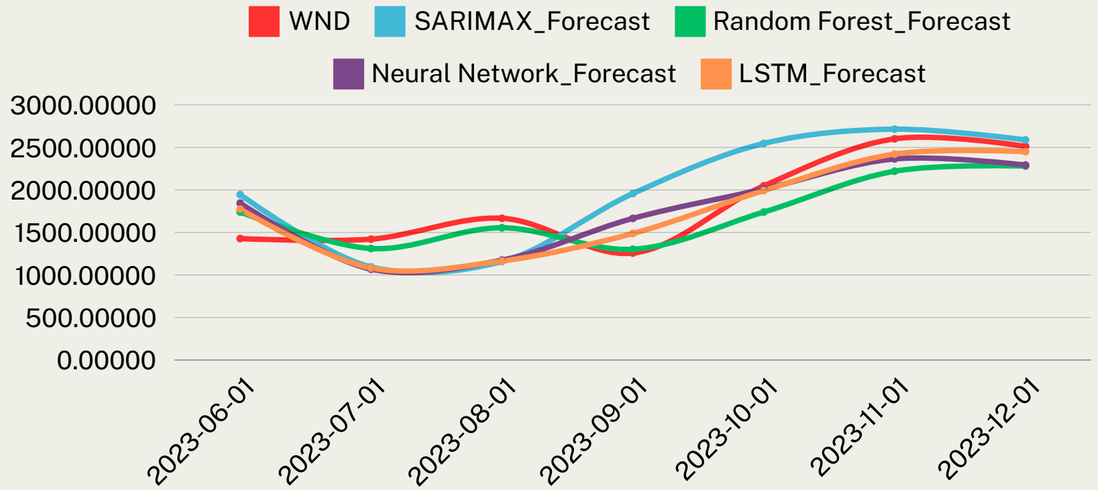


Wind Energy Forecast

Previous



Current



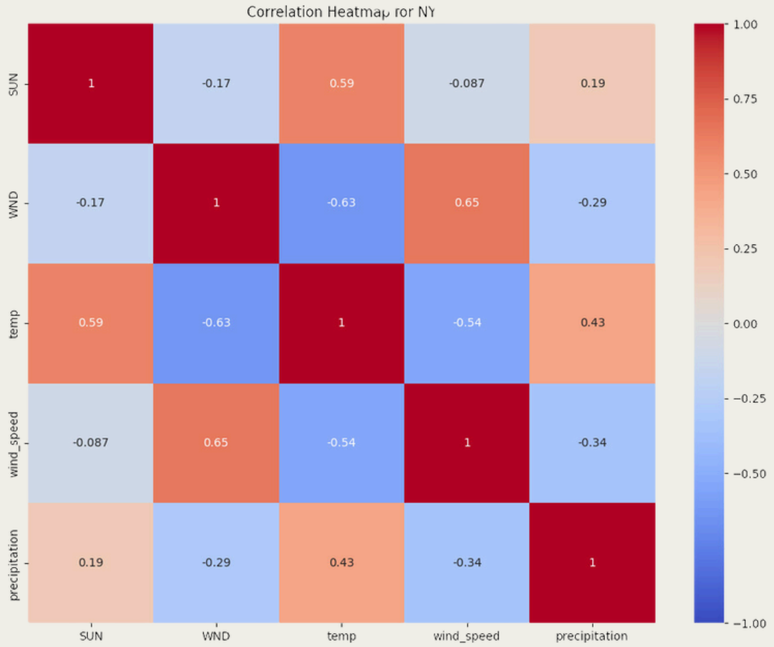
THE DATA

Data *overview*

Energy production and weather data on New York State, 2021 - 2023

Data *sources*

- **Energy production:**
  - U.S. Energy Information Administration API
- **Weather data:**
  - meteostat API



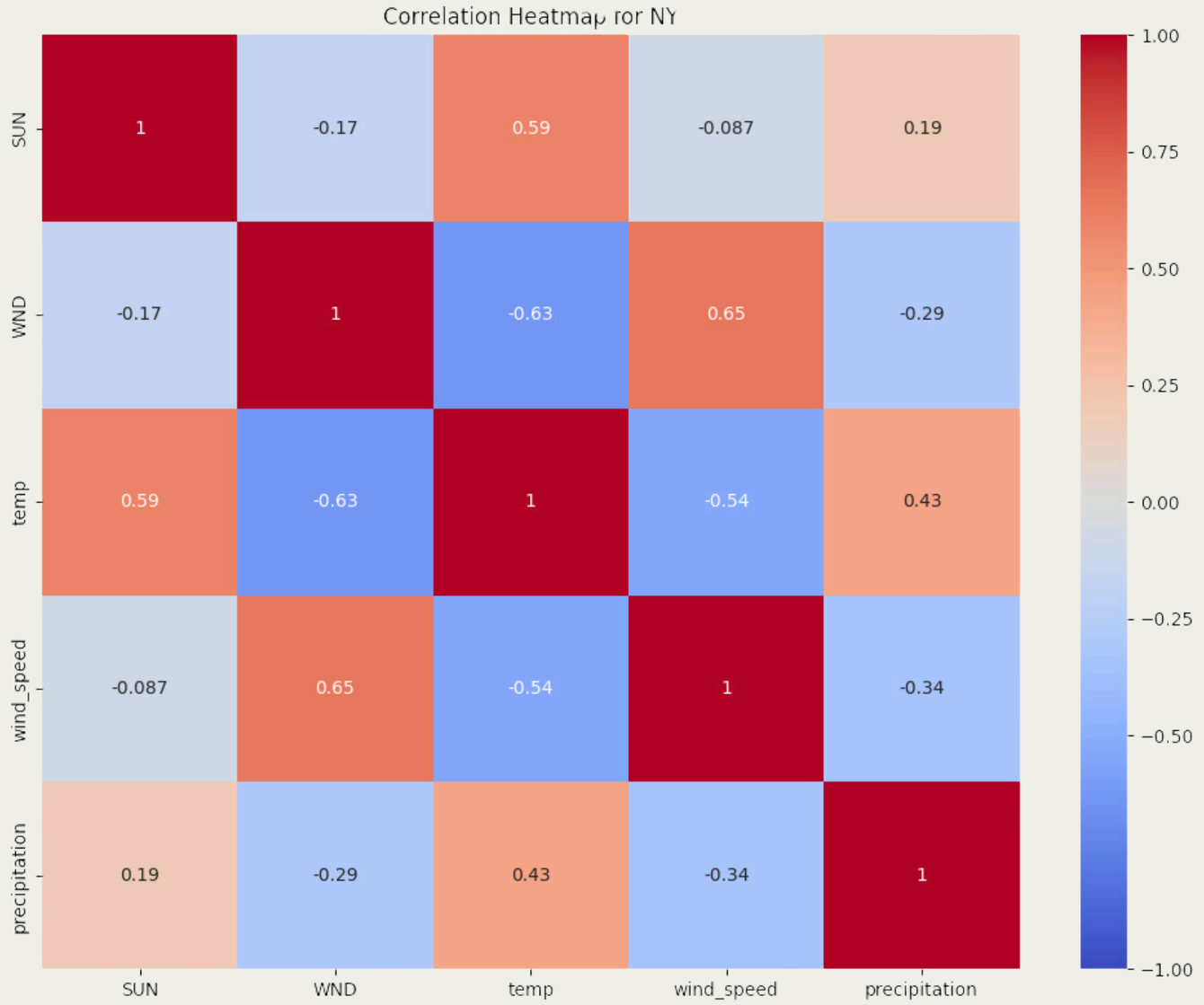
Key *variables*

- **date** - date of observation
- **SUN** - solar energy production in trillion BTU
- **WND** - wind energy production in trillion BTU
- **temp** - average temperature in °C
- **wind_speed** - average wind speed in km/h
- **precipitation** - total precipitation in mm

Data *quality concerns*

- limited geographic scope
- temporal resolution
- lacking energy output of each power source
- API is slow

THE DATA


Correlation Heatmap for NY
SUN
WND
temp
wind_speed
precipitation
1
-0.17
0.59
-0.087
0.19
-0.17
1
-0.63
0.65
-0.29
0.59
-0.63
1
-0.54
0.43
-0.087
0.65
-0.54
1
-0.34
0.19
-0.29
0.43
-0.34
1
SUN
WND
temp
wind_speed
precipitation
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−1.00

NEXT STEPS

Expand dataset

1

- Explore broader region
- Extract data on power plant locations
- More variables such as satellite imagery and geospatial data

Feature engineering

2

- Lag features
- seasonal indicators

Modeling

3

- Expand modeling approaches
- Ensemble methods
- Hyperparameter tuning

Implementation

4

- Implement computer vision on satellite data
- Use NLP for analyzing policy documents and sentiment on building power plants

Deploy

5

Create dashboard for a site optimization model for determining optimal locations for renewable energy based on supply and demand conditions

Thank you!