

US Solar Power Output Time Series Analysis

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Agenda

01.

Business Overview

Stakeholder problem

02.

Data Overview

Data explanation and
Exploratory Data Analysis

03.

Methods

Analysis, Modeling, and
Forecasting

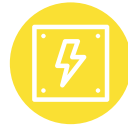
04.

Next Steps

Evaluations and
Recommendations



Business Overview



North American Electric Reliability Corporation (NERC)

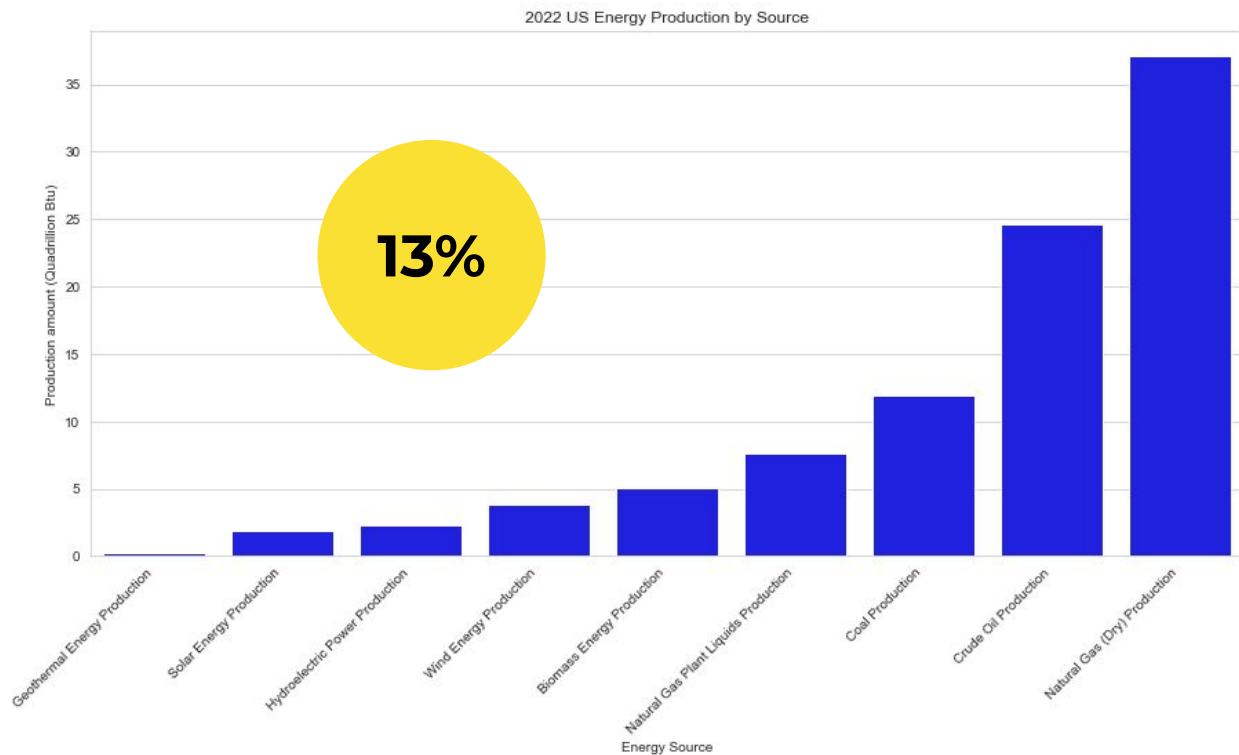


NERC wants to know how much power to expect from renewable sources.



They have asked us to try to forecast solar output in order to help them manage the grid better.

Renewable Energy in the US



1	Biomass	4.97%
2	Wind	3.74%
3	Hydroelectric	2.25%
4	Solar	1.82%
5	Geothermal	0.21%

Figures reflect 2022 Net Energy Production

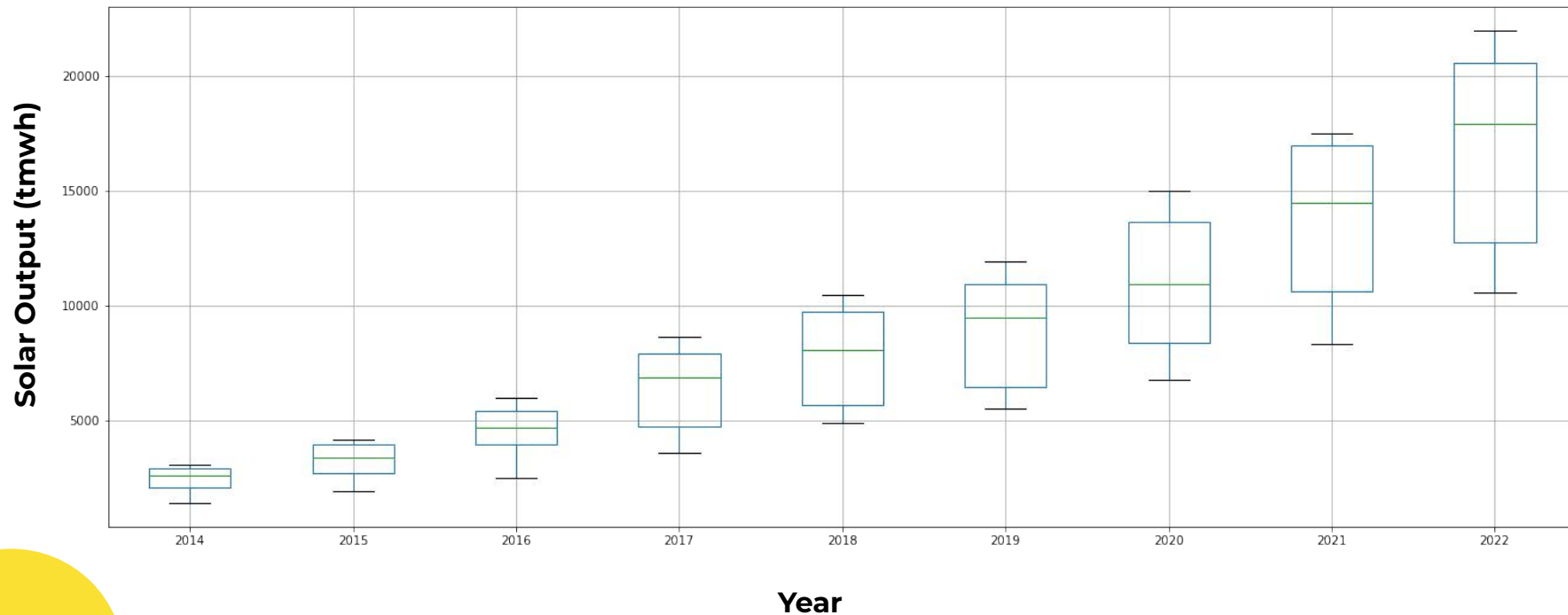
Data Understanding

- **Source:** U.S. Energy Information Administration-Electricity Data Browser
- **Solar output data** in **thousand megawatthours** grouped by state, region, and **US Total**
- **Monthly** frequency from **Jan 2014** to **Dec 2022**

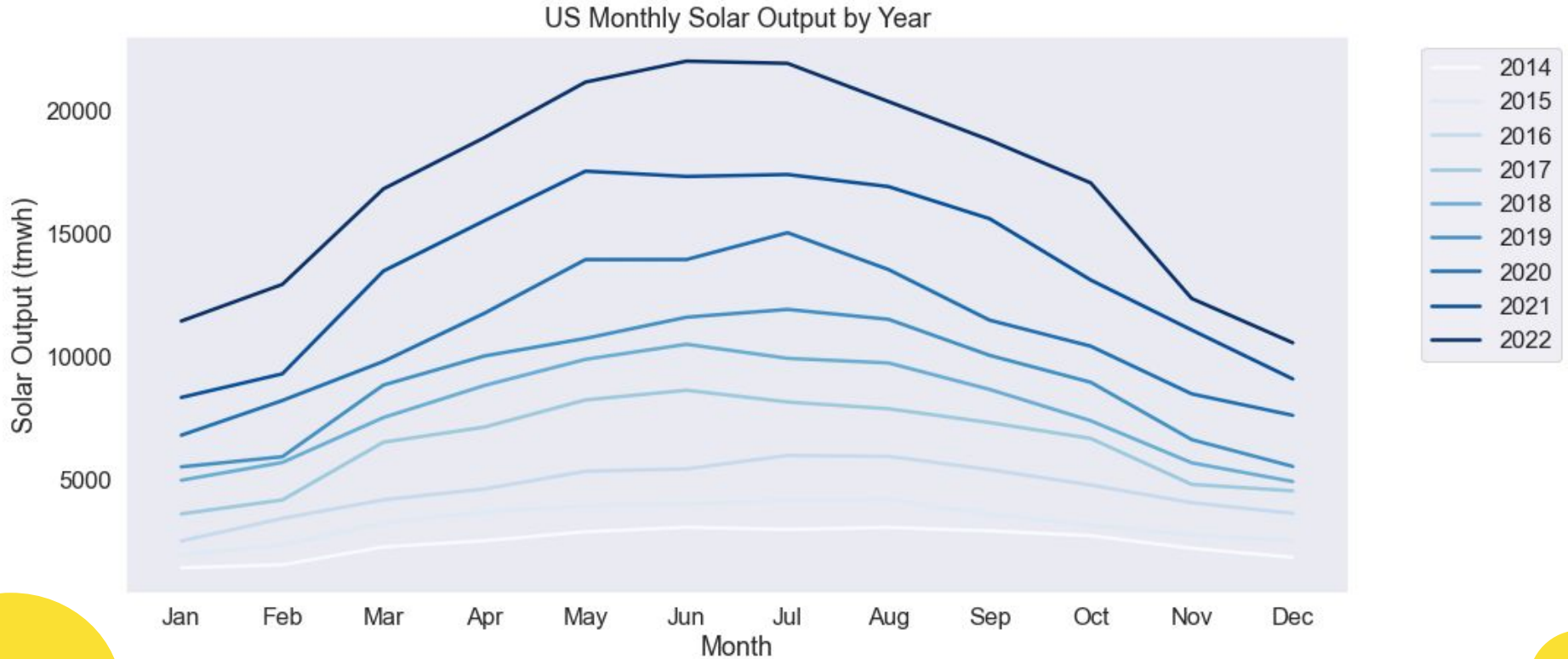


Data Understanding

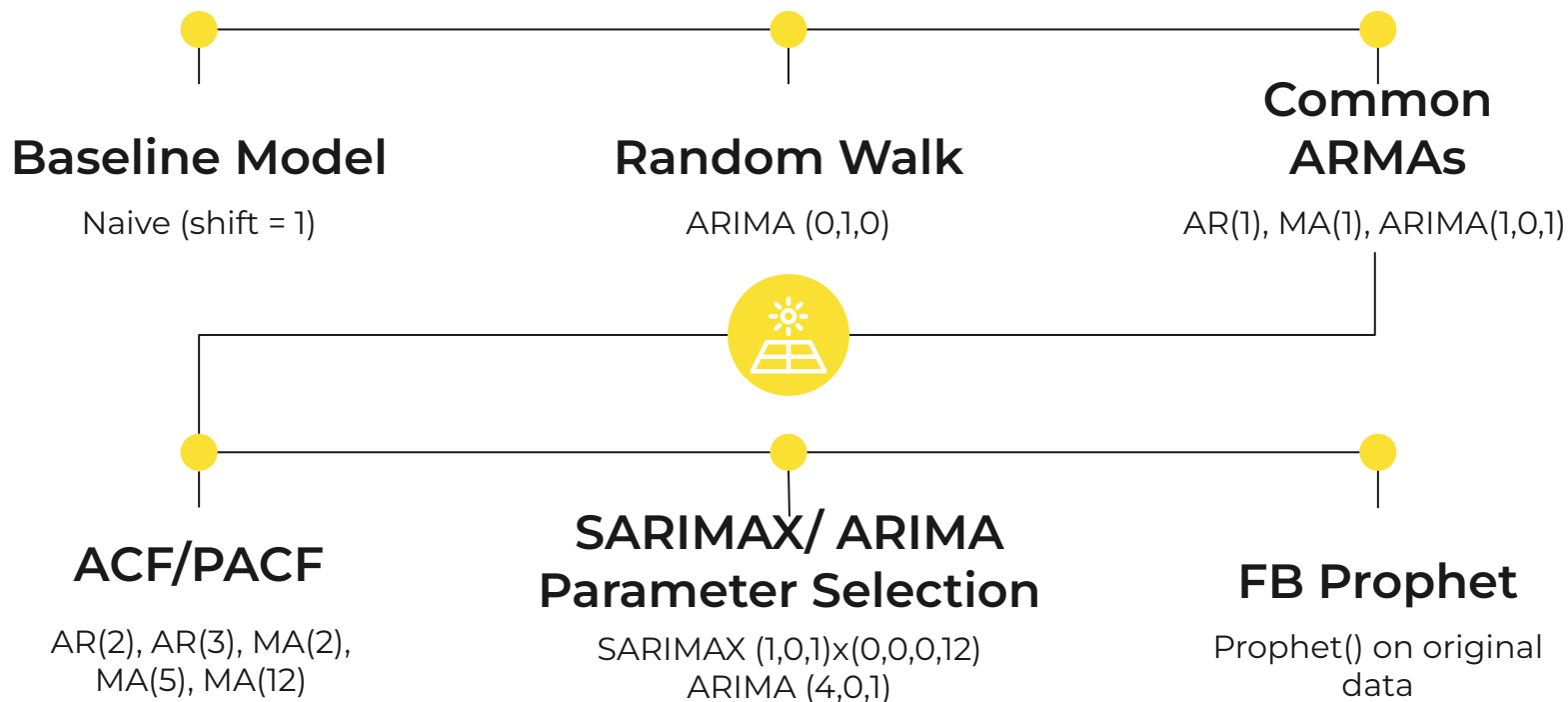
Yearly US Solar Power Output



Data Understanding: Seasonality



Methods



Model Evaluation

Final Model

ARIMA (4,0,1)

AIC

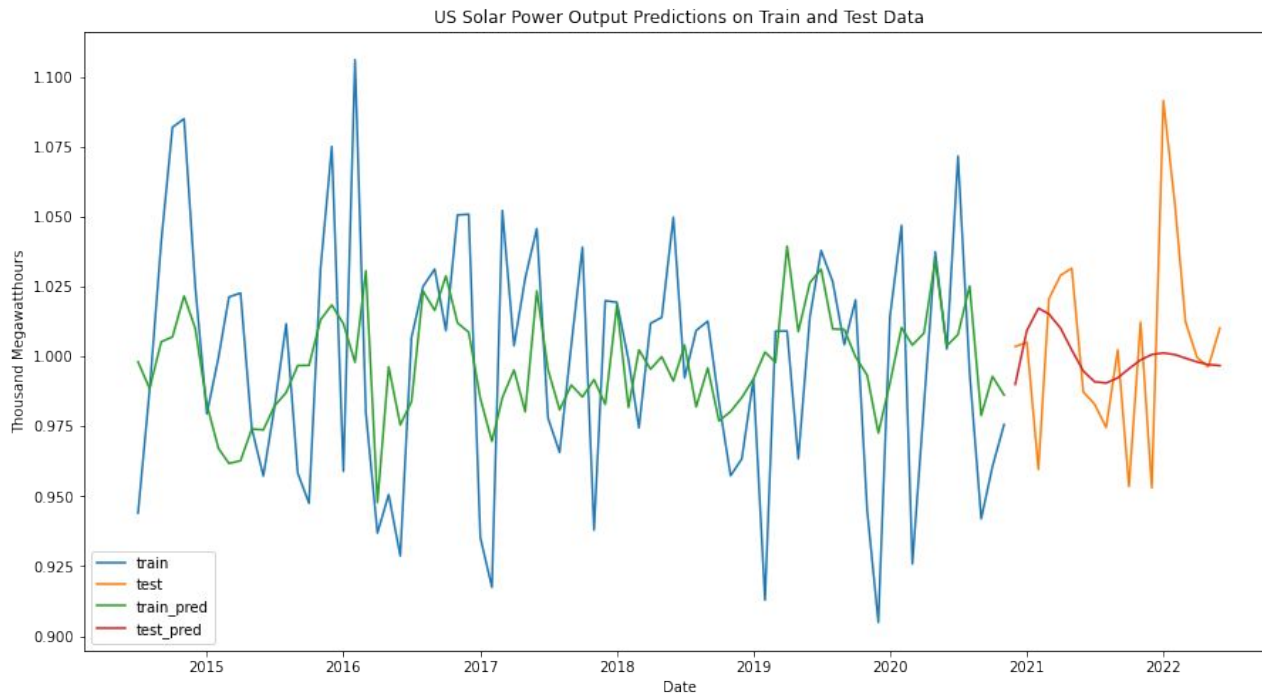
-266.14

RMSE (Test)

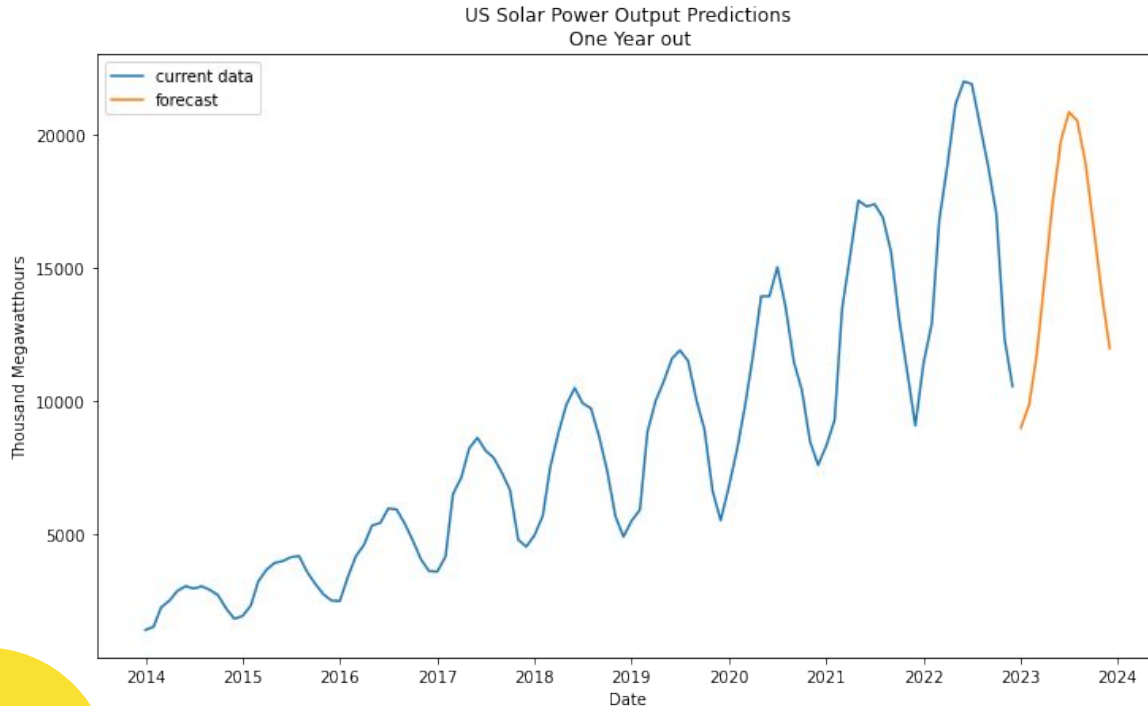
**0.033 thousand
megawatthours**

MAPE (Test)

2.32%



Solar Power Output Forecast



ARIMA401

Follows the overall trend and
multiplicative increase in
variance

Recommendations

- Create a forecast to predict supply and avoid blackouts/grid failure caused by overproduction.
- Prepare plan to meet seasonal supply and demand in conjunction with traditional energy sources.

Next Steps

Evaluate Forecast

Calculate error on forecast versus observed data

Add more data

Include power plant counts and environmental factors (weather, solar irradiation)

Increase specificity

Repeat forecasting at the regional and state level



Thank You

Questions?



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