

A nighttime photograph of the Calgary skyline. The Calgary Tower, illuminated in blue, stands prominently in the center-left. The background is filled with numerous high-rise buildings, their windows glowing with warm yellow and orange lights. In the foreground, a bridge with ornate stone arches and lion statues is visible, with light trails from passing vehicles creating streaks of white and yellow. A dark blue semi-transparent rectangle is overlaid on the left side of the image, containing white text.

FORECASTING CALGARY'S ENERGY CONSUMPTION DATA USING TIME SERIES ANALYSIS

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INTRODUCTION

- A **time series** analysis focuses on a series of data points ordered in time.
- **Objective** : Forecast Calgary's weekly energy consumption for the year 2022 using actual historical records of Calgary's weekly energy consumption from 2017-01-01 to 2021-12-31
- **Methodology**:
 - Prediction models: Simple Exponential Smoothing (SES), Holt, and Seasonal ARIMA (SARIMA).
 - Determining the best prediction model
 - Making predictions using the best prediction model

STEP I: DATA VISUALIZATION

Data preprocessing steps:

1. Create a Date column using the
2. Obtain the weekly energy consumptions using daily energy consumptions.
3. Plot the dataset
4. Handle missing values

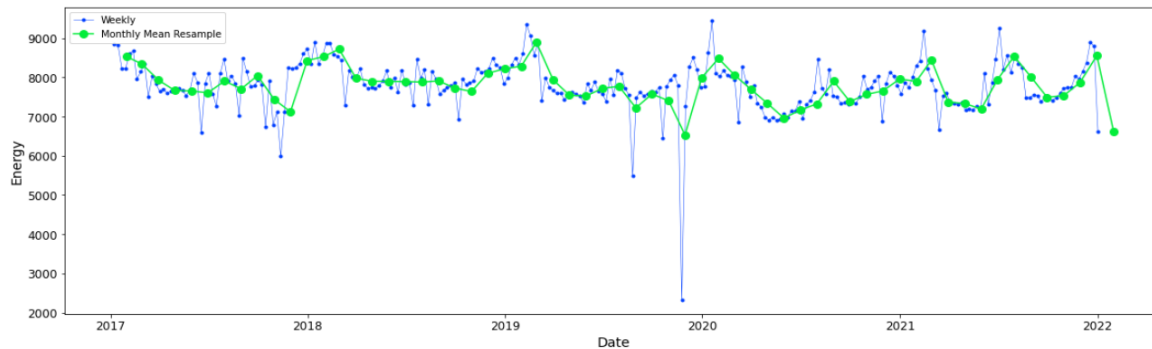


Fig 1: Plotting Data

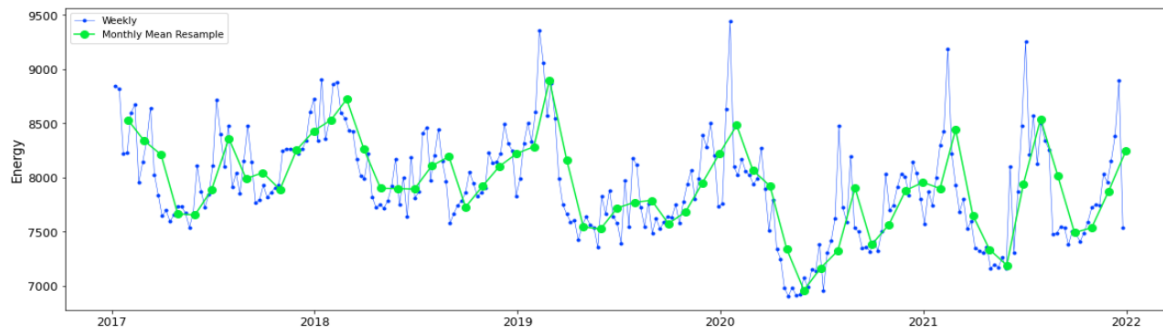


Fig 1: Plotting Data after handling missing values

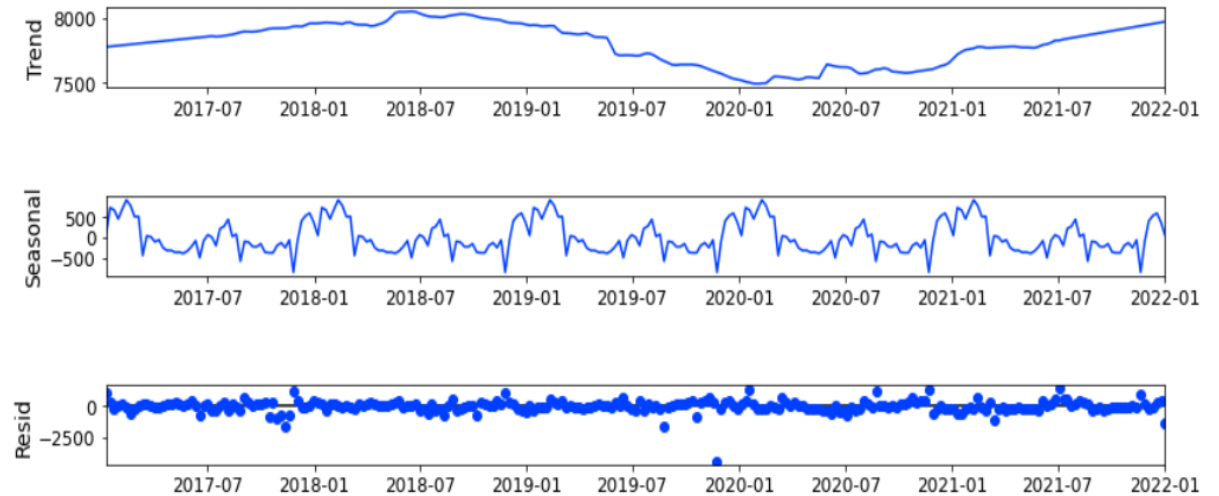
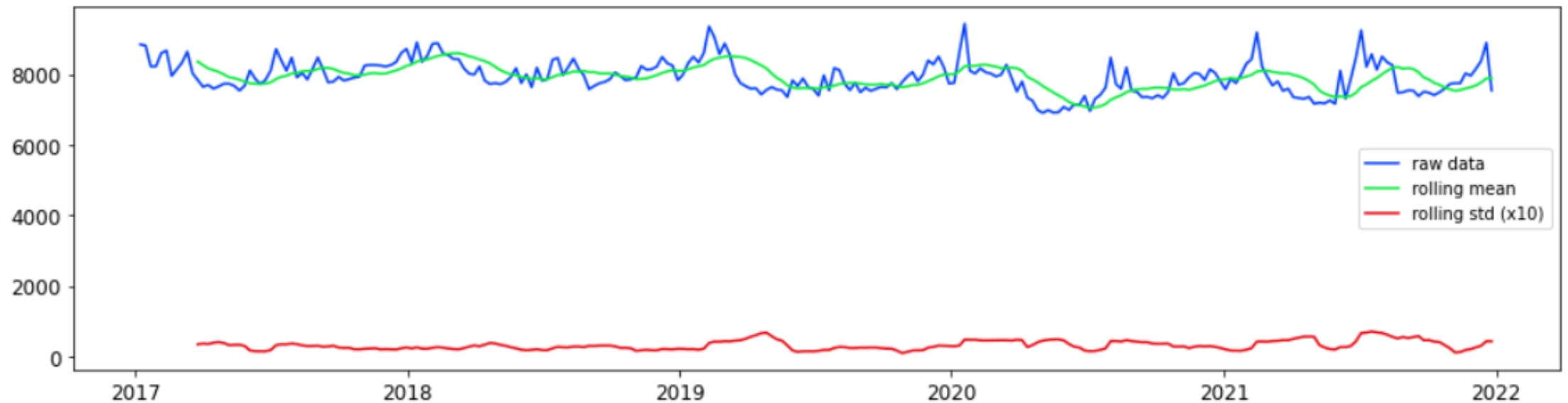


Fig 3: Decomposing Data

STEP 2: CHECK FOR STATIONARY

Fig 3: Visualizing Rolling Statistics



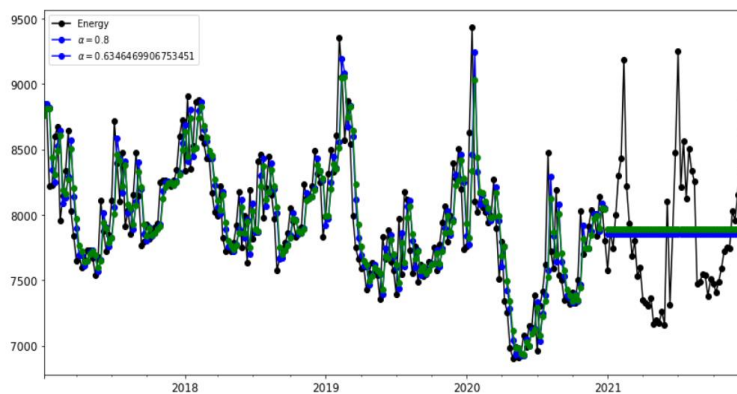
Augmented Dickey-Fuller Test

- Is the raw data stationary ? Test statistic = -4.677 P-value = 0.000
- Critical values :
 - 1%: -3.4561550092339512 - The data is stationary with 99% confidence
 - 5%: -2.8728972266578676 - The data is stationary with 95% confidence
 - 10%: -2.5728222369384763 - The data is stationary with 90% confidence

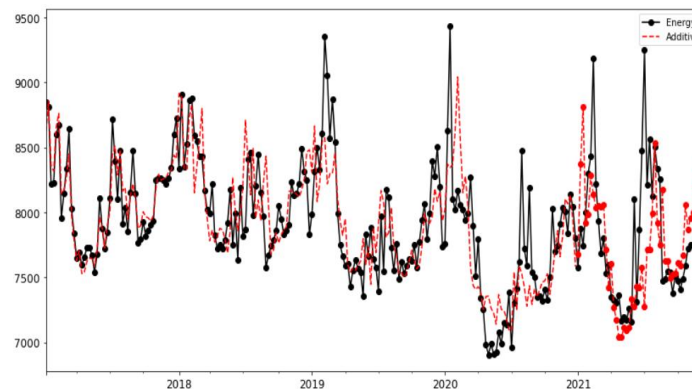
STEP 3: CHOOSING A TIME SERIES PREDICTION MODEL

- Now let's consider three forecasting models:
 - ✓ Simple Exponential Smoothing (SES) for data without trend or seasonality
 - ✓ Holt-Winters' Seasonal Method for data with trend and/or seasonality
 - ✓ SARIMA for data with trend and/or seasonality

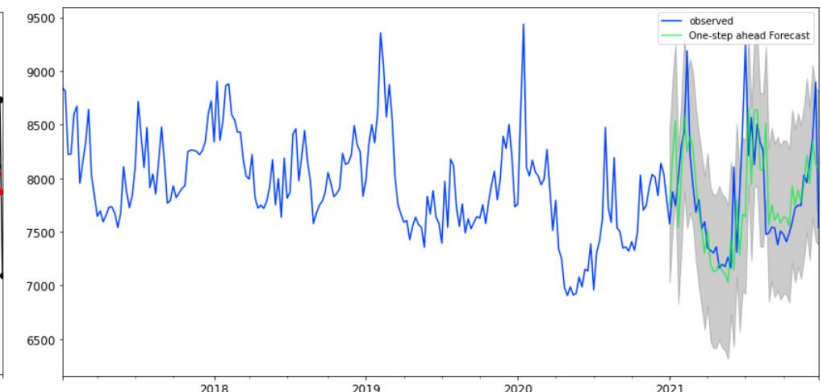
Model	RMSE
Simple Exponential Smoothing (SES)	508.03
Holt's Linear Trend Method	480.41
SARIMA	454.2



Simple Exponential Smoothing (SES)



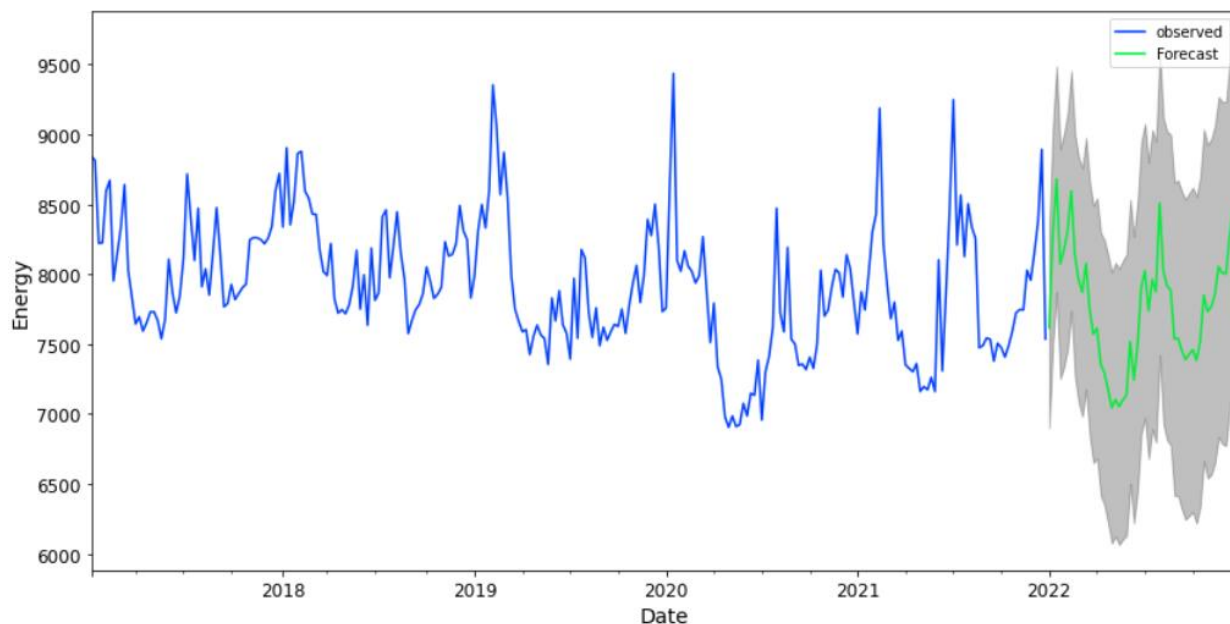
Holt-Winters' Seasonal Method



SARIMA Method

STEP 4: MAKING PREDICTIONS

Compared with the results of all the previous models, we can be confident saying the SARIMA model best captures both the seasonality and trend of our dataset.



	Date	Predicted_Mean	Lower Bound	Upper Bound
0	2022-01-02	7616.83111892	6900.46284376	8333.19939409
1	2022-01-09	8282.39276309	7497.96589346	9066.81963272
2	2022-01-16	8679.82018246	7871.69657436	9487.94379055
3	2022-01-23	8073.74212358	7250.94966744	8896.53457971
4	2022-01-30	8170.24526658	7335.26094632	9005.22958683

CONCLUSION

- Time series analysis and prediction is a huge and fascinating area with a wide range of complexity and applications..
- We forecasted Calgary's energy consumption for year 2022 using SARIMA model.
- Code: [Forecasting-Energy-Consumption-Data-Using-Time-Series-Analysis/Time Series Prediction.ipynb at main · rangikagmg/Forecasting-Energy-Consumption-Data-Using-Time-Series-Analysis \(github.com\)](#)