Time Series Analysis and Forecasting

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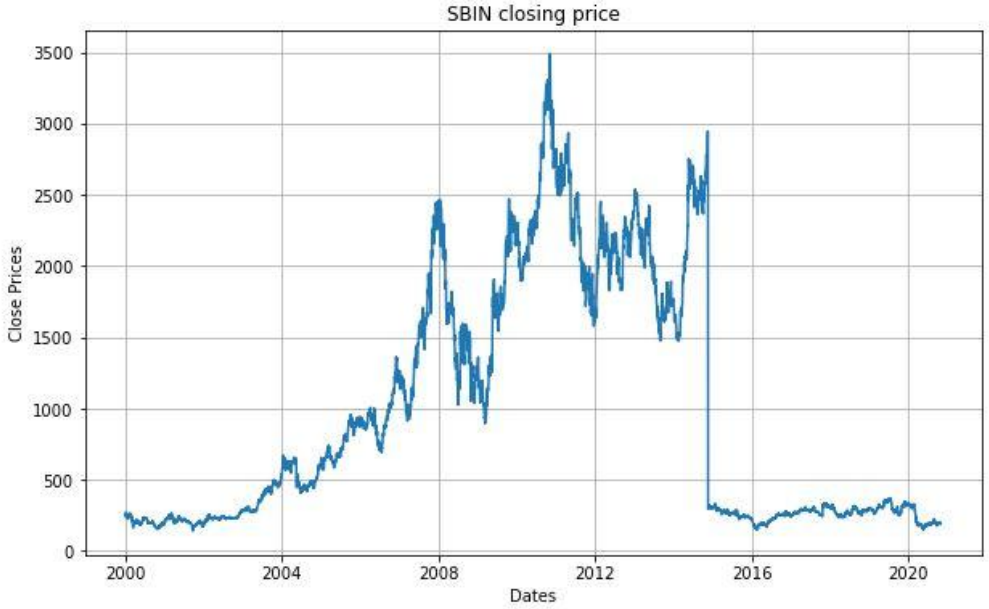
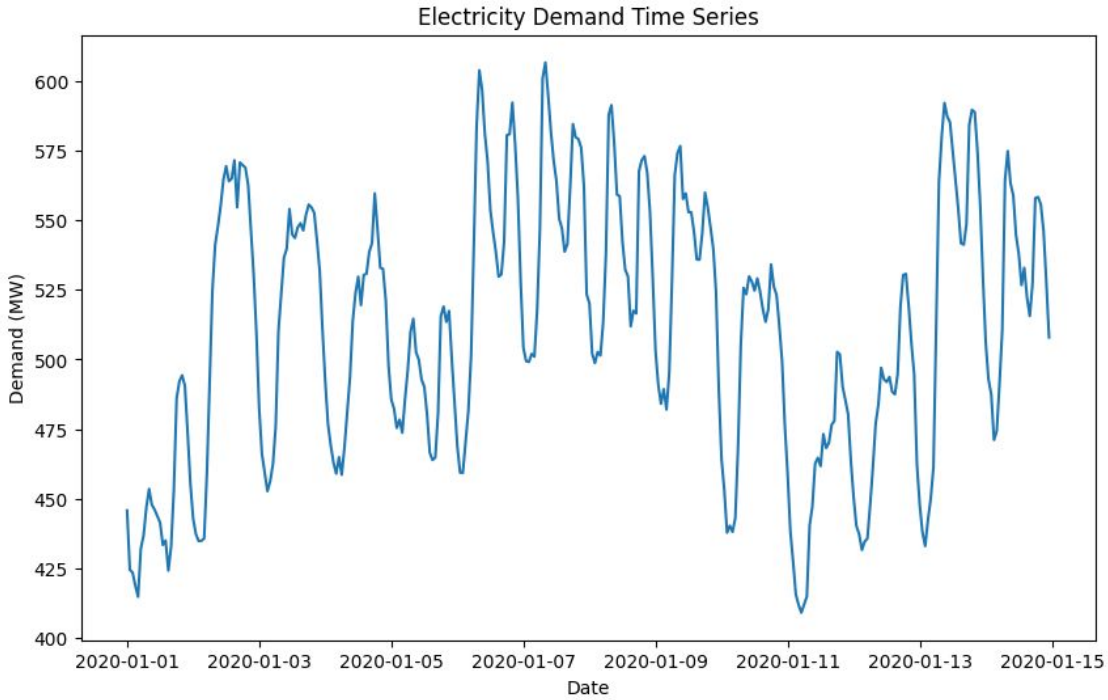
Time Series Example



Time Series: Set of observations recorded over time

Energy Demand - Time series data

datetime	Demand (MW)
2020-01-01 00:00:00	445.8
2020-01-01 01:00:00	424.5
2020-01-01 02:00:00	423.5
2020-01-01 03:00:00	418.8
2020-01-01 04:00:00	414.8



Objective - Time Series Forecasting

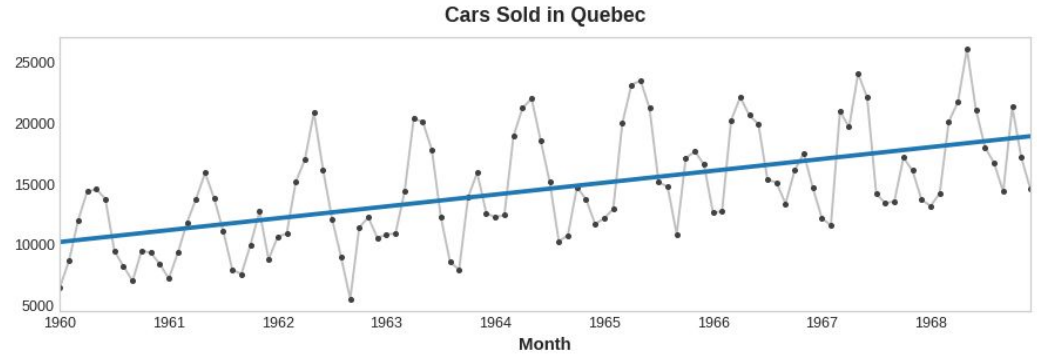
1. Prediction of future values
2. Planning and Decision Making
    a. Electricity demand in festivals
3. Anomaly Detection
    a. Identify unusual weather events
    b. Traffic Pattern in web

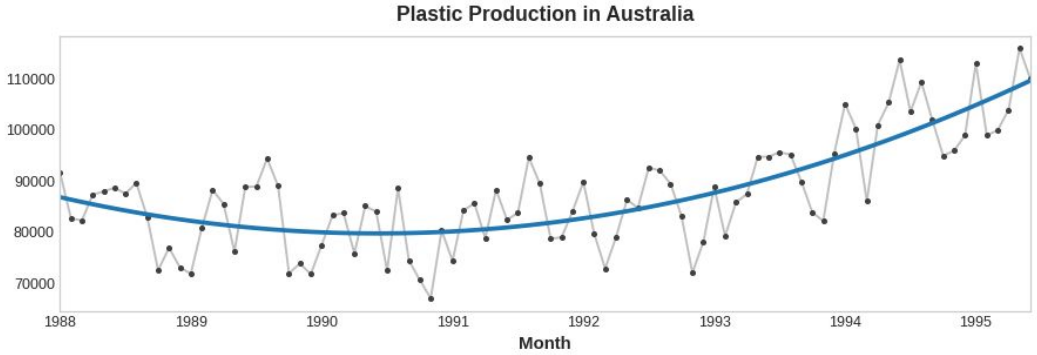
Major Components of Time Series

1. Trend
2. Seasonality
3. Cycles

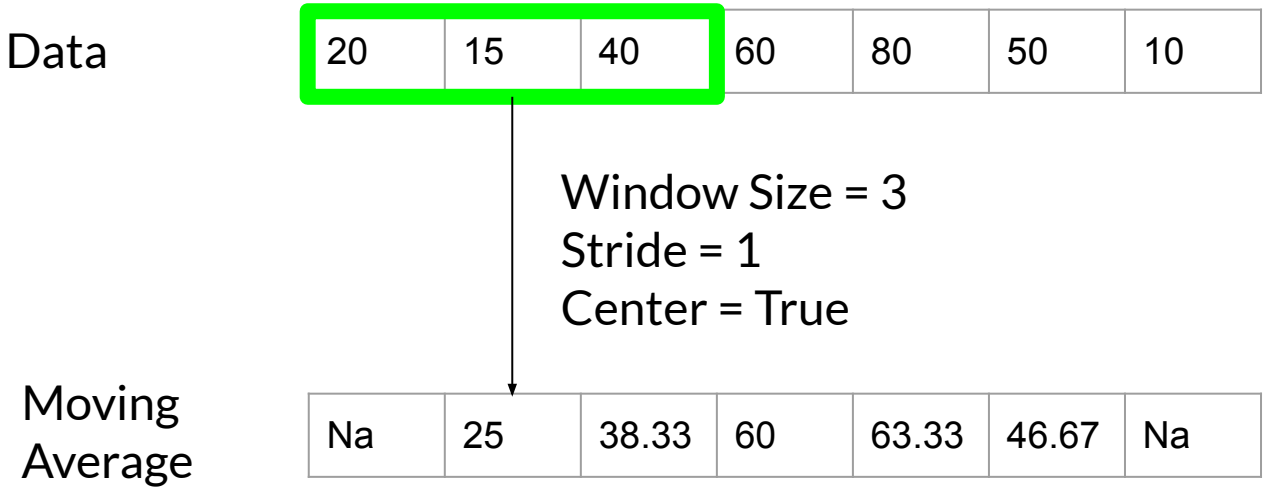
Trend

A long-term movement or direction in a time series, indicating an overall increase or decrease in data over time.

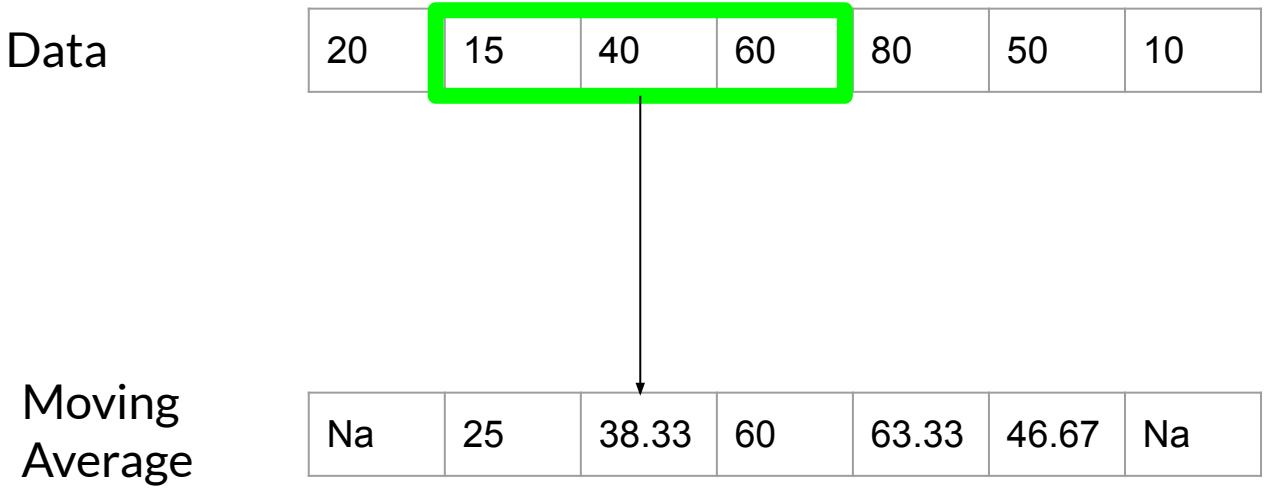




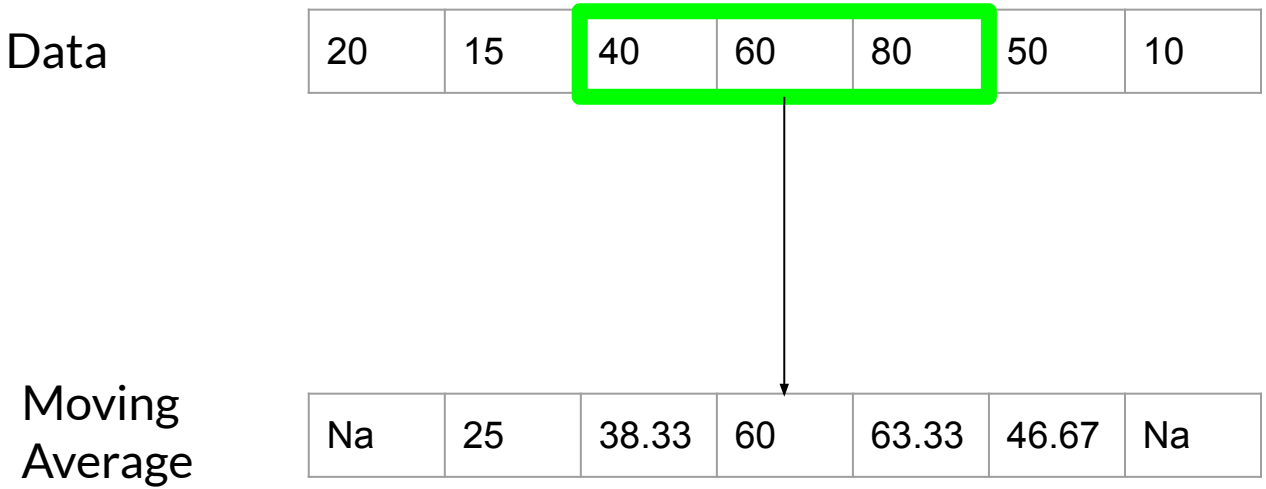
Moving Average



Moving Average



Moving Average



Trend analysis - Moving Average

datetime	Demand (MW)
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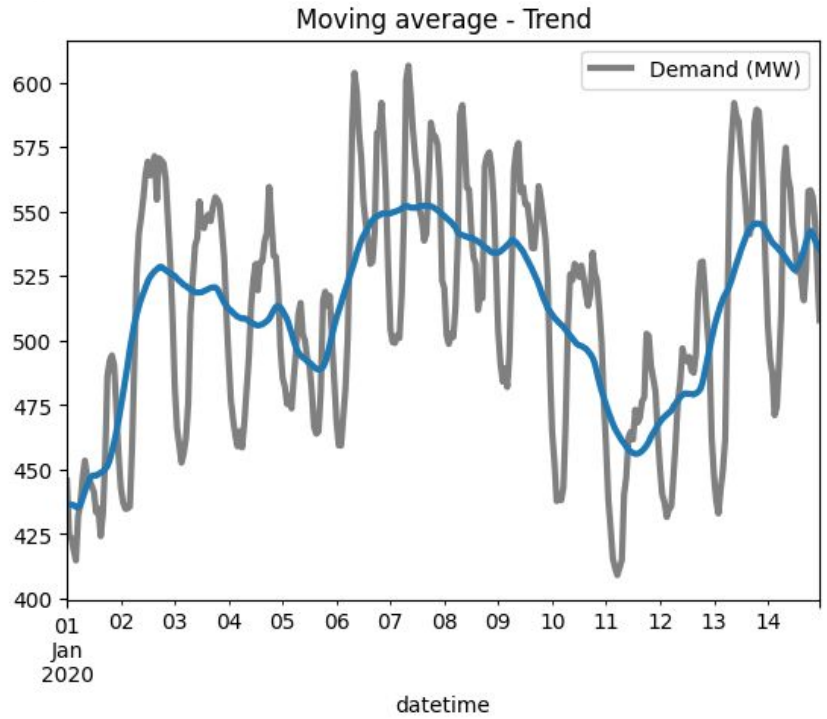
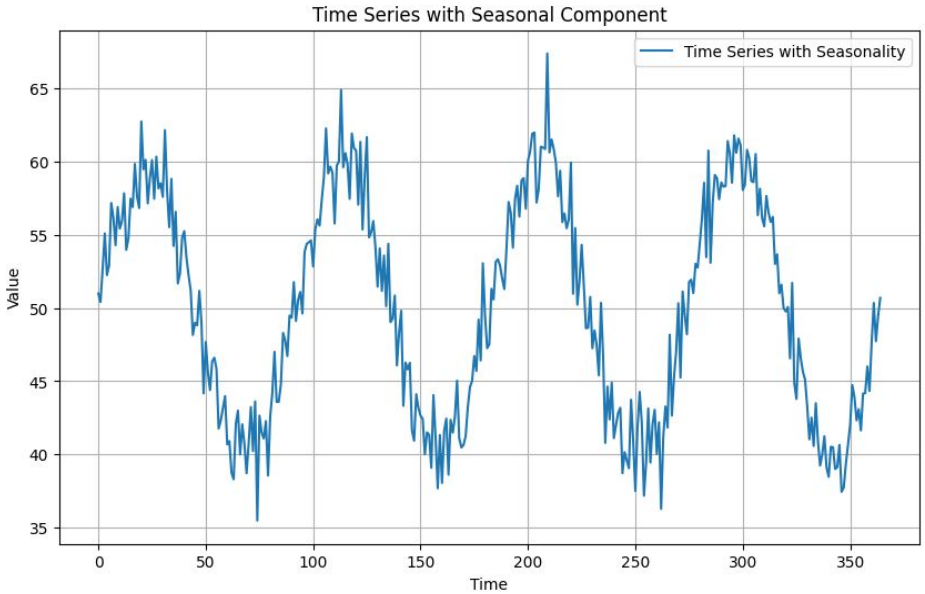
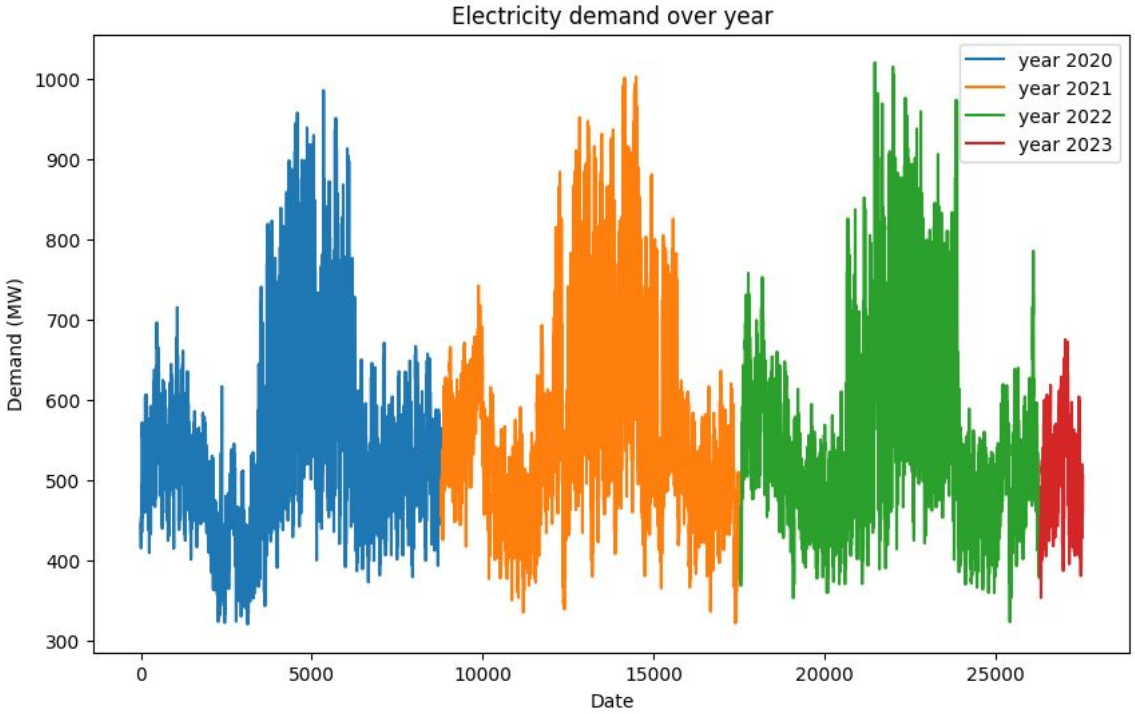


Seasonality

Regular and predictable patterns or cycles in a time series that repeat at specific intervals, such as daily, monthly, or yearly.

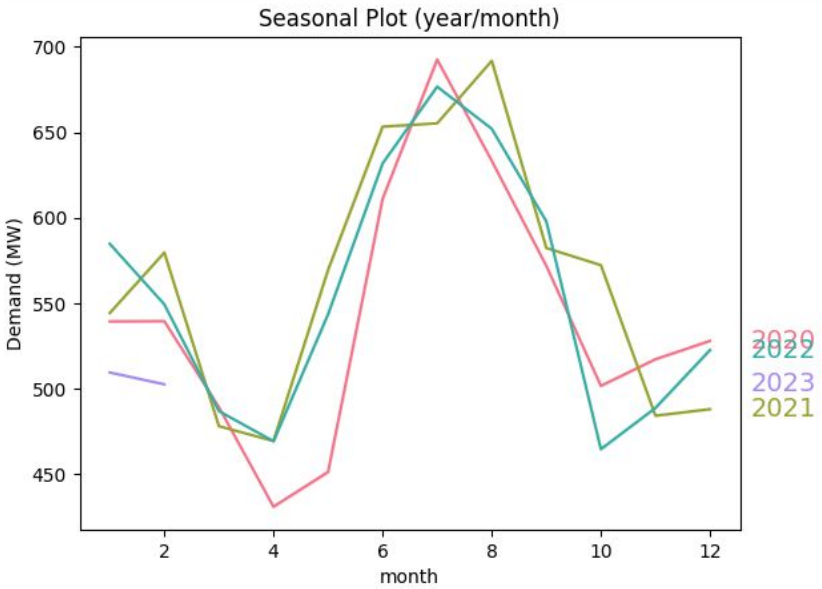


Seasonality in Energy Demand



Annual Seasonality in Demand series

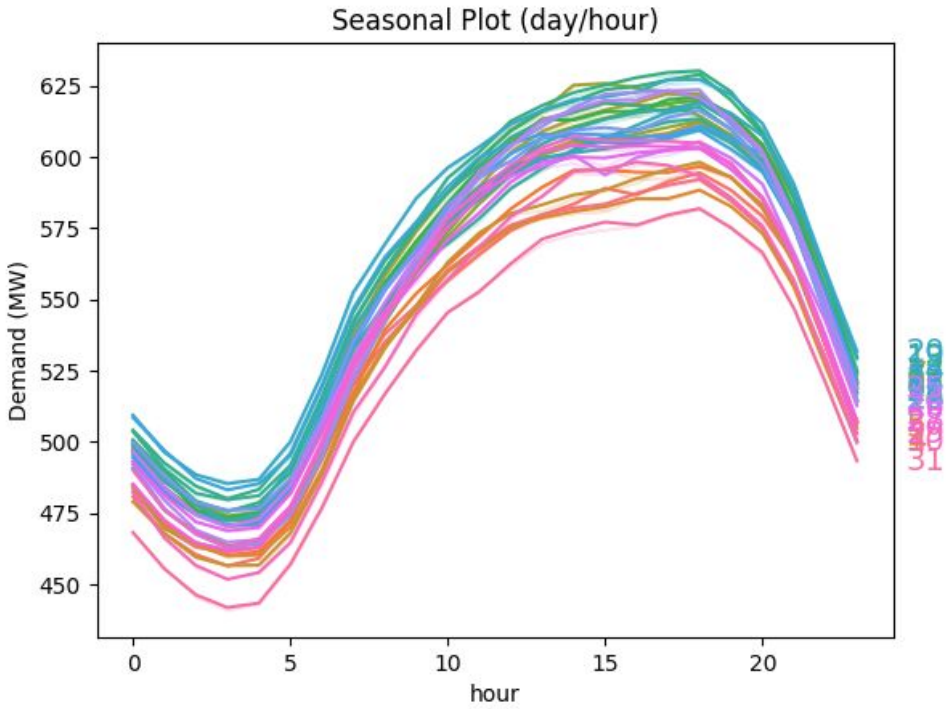
Repeated pattern over the years can be observed for the energy demand.



Daily Seasonality in Demand series

3pm - 8pm
Higher energy demand

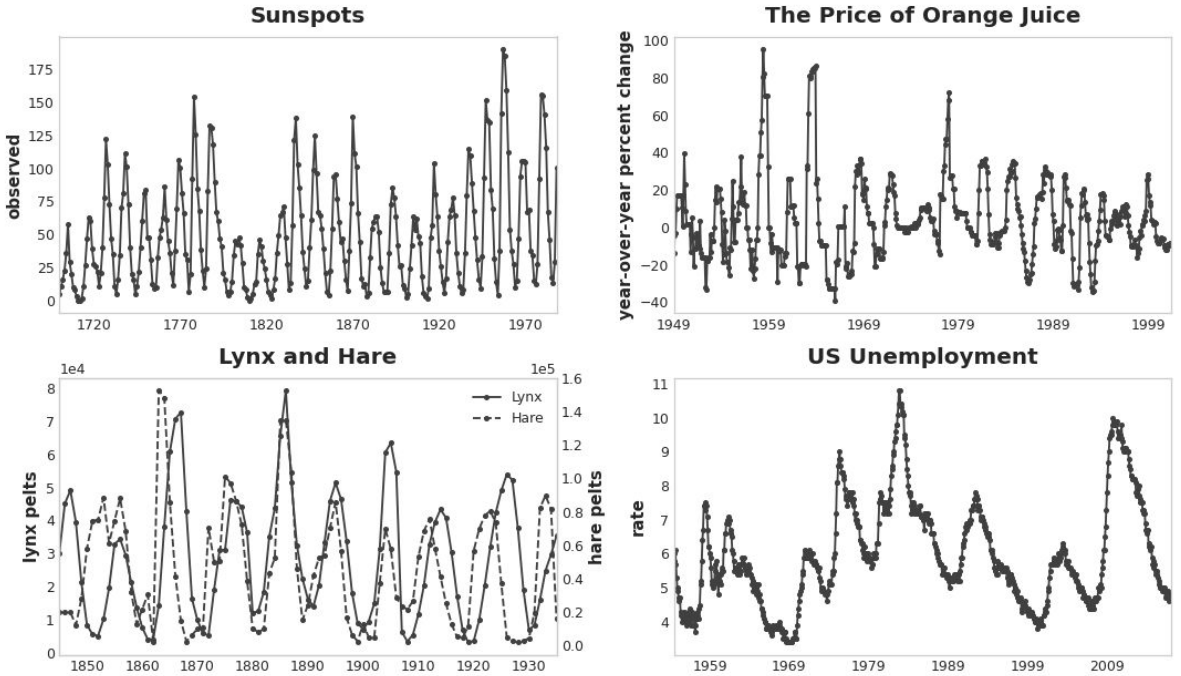
1am - 5am
Lower energy demand



Cycles

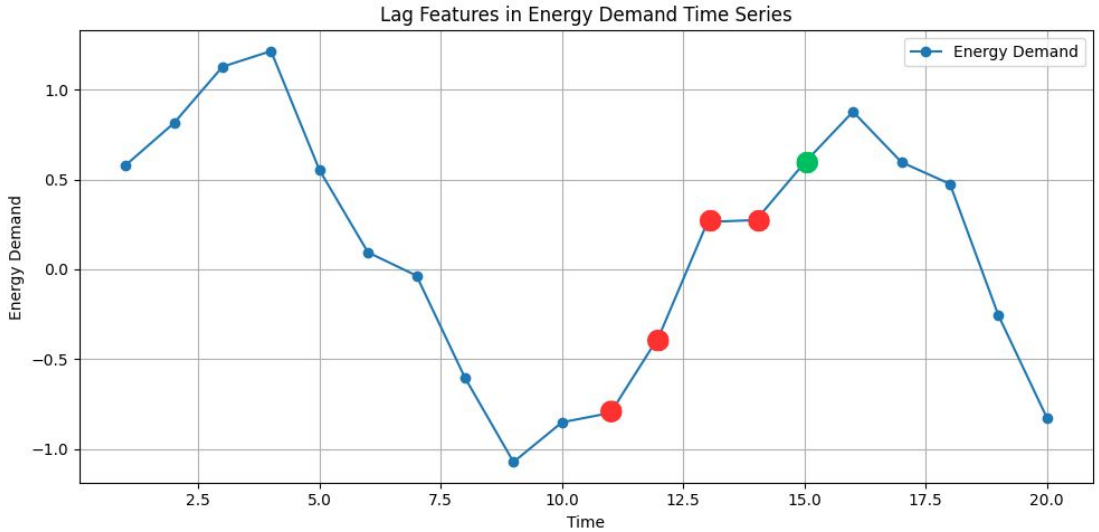
Patterns of growth and decay just like seasonality

BUT,
Cycles doesn't depend on time.



Lags Feature

Cycles is associated with how values in a series at one time **depends** on the values in the previous time.



Key Takeaways

A time series is a collection of data points or observations indexed in the order of time.

The long-term increase or decrease in data is trend.

The periodic repetition in the pattern is called seasonality.

Independent and identically distributed(iid assumptions) is not valid for time series. Hence, many conventional ML techniques cannot be applied, suggesting new statistical models need to be built for time series analysis