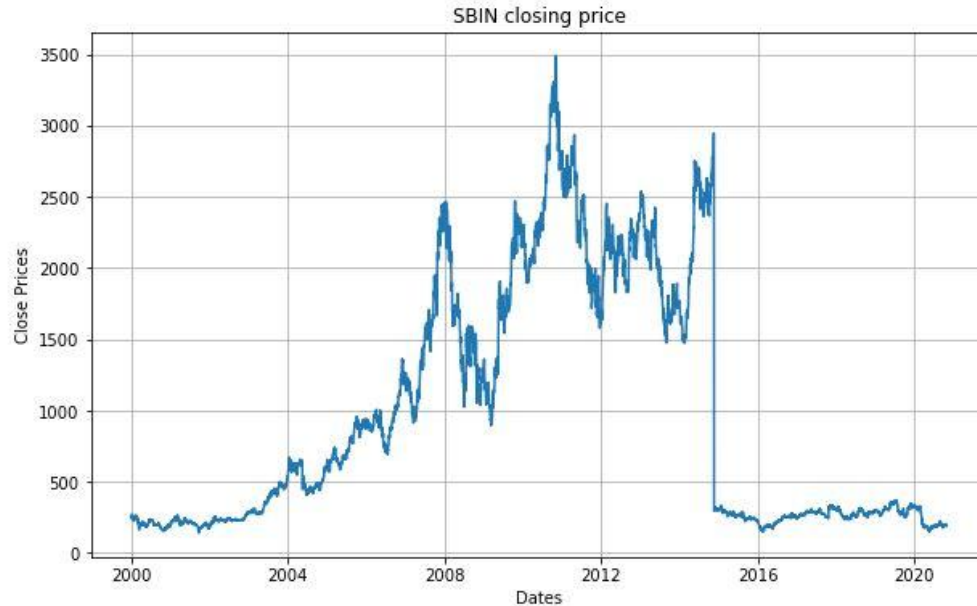

Time Series Analysis and Forecasting

Nirajan Bekoju

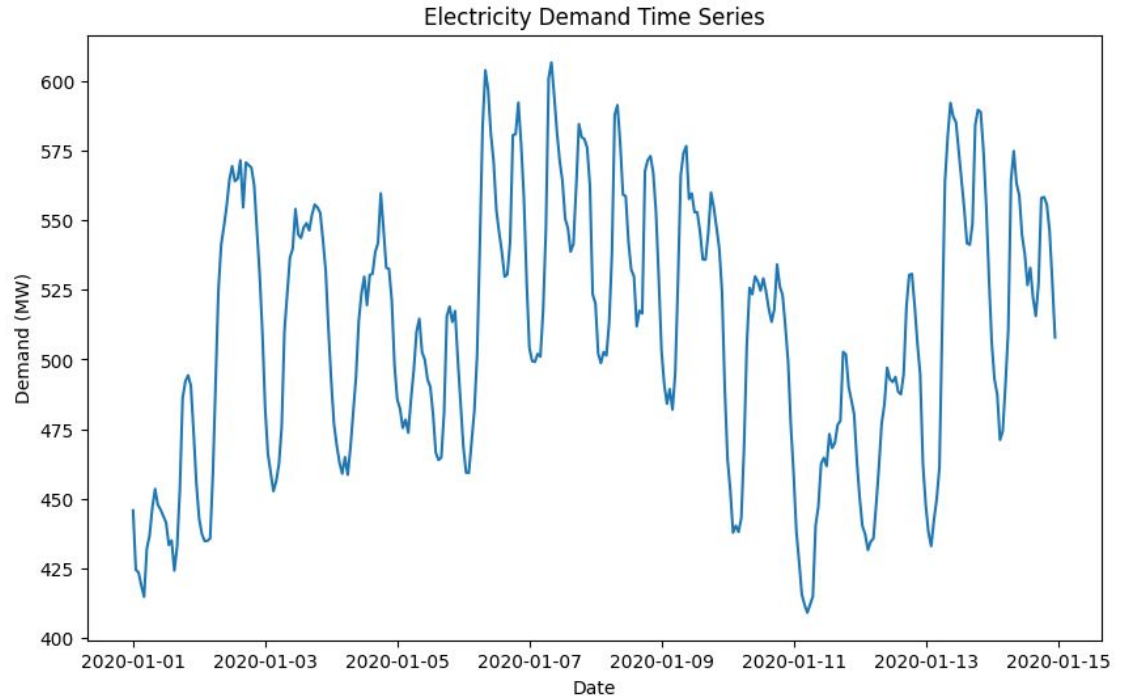
Time Series Example



Time Series: Set of observations recorded over time

Energy Demand - Time series data

	Demand (MW)
datetime	
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

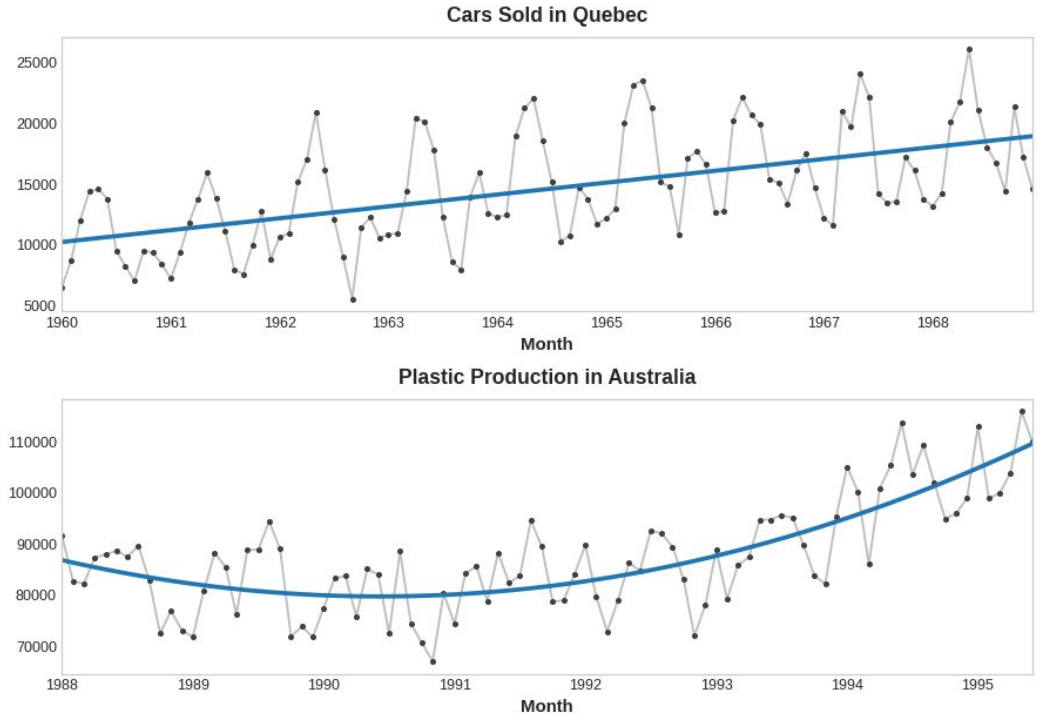
1. Prediction of future values
2. Planning and Decision Making
 - a. Electricity demand in festivals
3. Anomaly Detection
 - a. Identify unusual weather events
 - b. Traffic Pattern in web

Major Components of Time Series

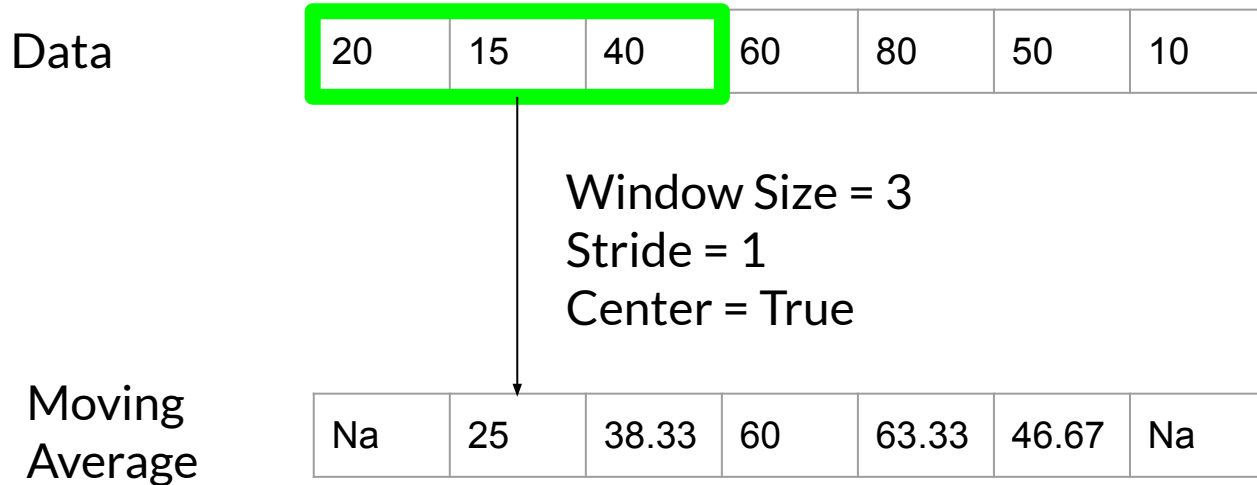
1. Trend
2. Seasonality
3. Cycles

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

Data

20	15	40	60	80	50	10
----	----	----	----	----	----	----

Moving
Average

Na	25	38.33	60	63.33	46.67	Na
----	----	-------	----	-------	-------	----

Moving Average

Data

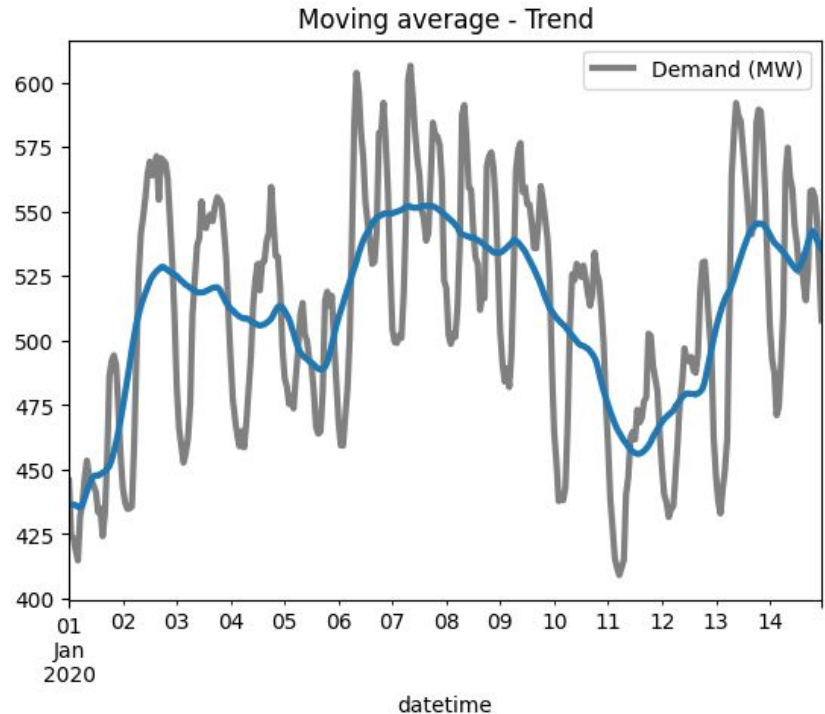
20	15	40	60	80	50	10
----	----	----	----	----	----	----

Moving
Average

Na	25	38.33	60	63.33	46.67	Na
----	----	-------	----	-------	-------	----

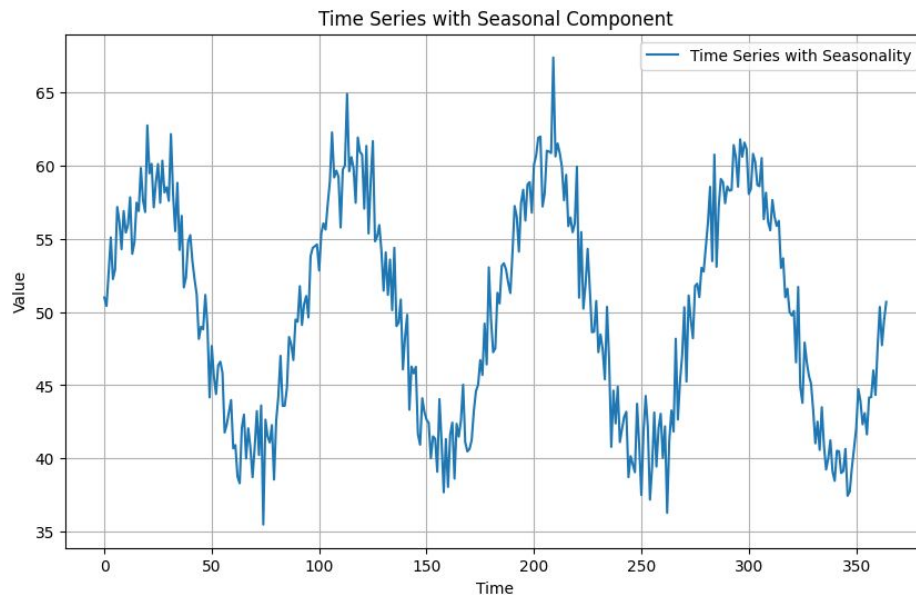
Trend analysis - Moving Average

	Demand (MW)
datetime	
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

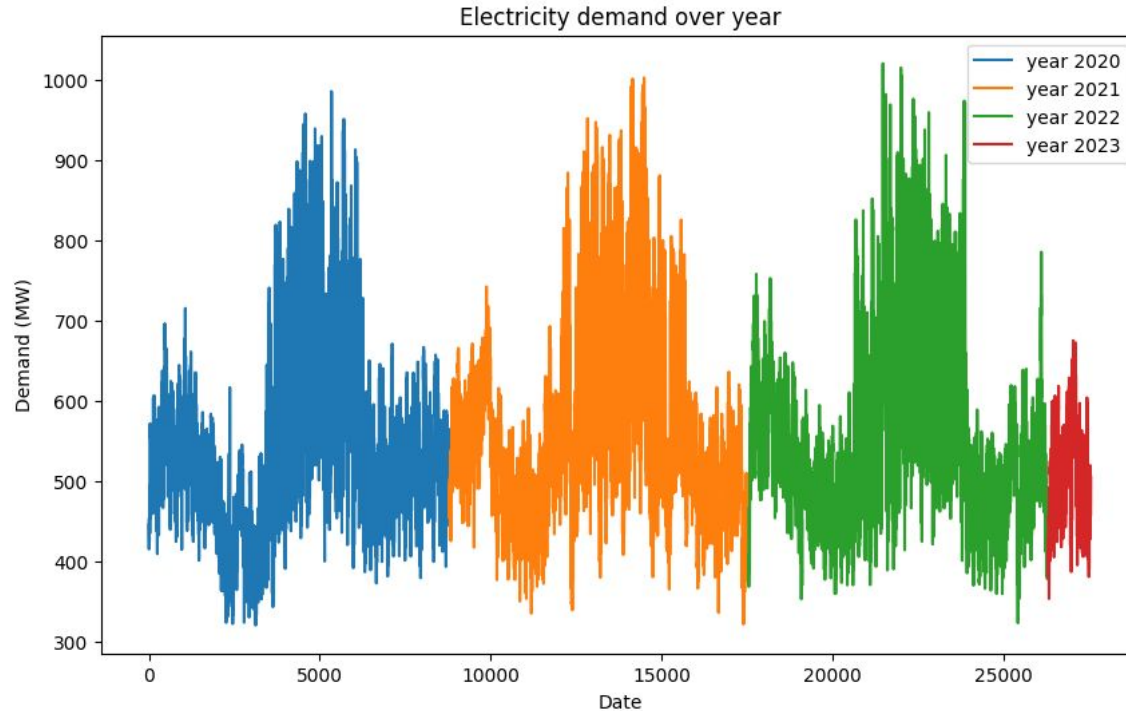


Seasonality

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

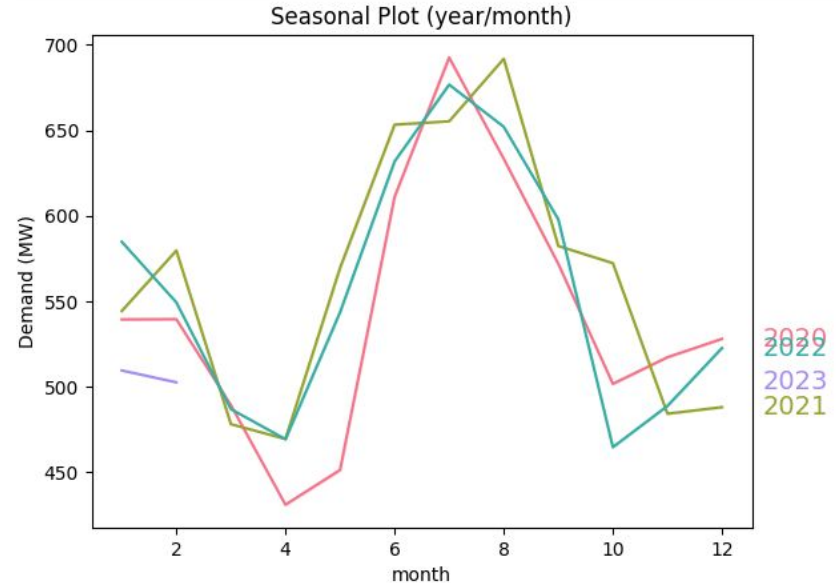


Seasonality in Energy Demand



Annual Seasonality in Demand series

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



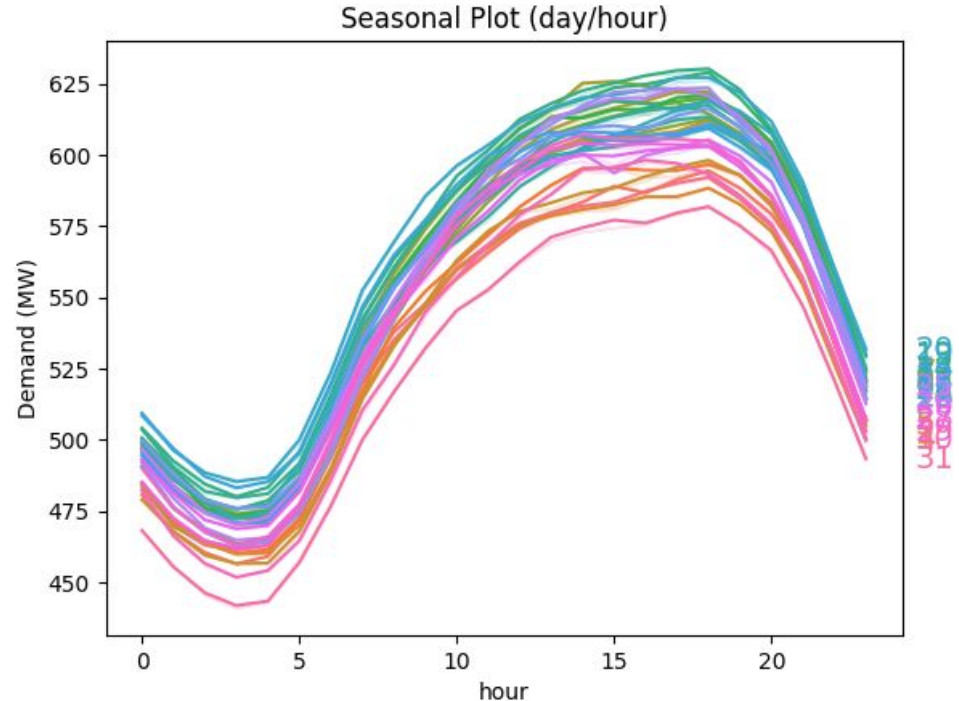
Daily Seasonality in Demand series

3pm - 8pm

Higher energy demand

1am - 5am

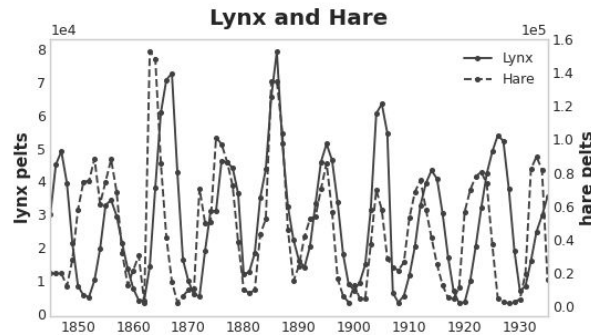
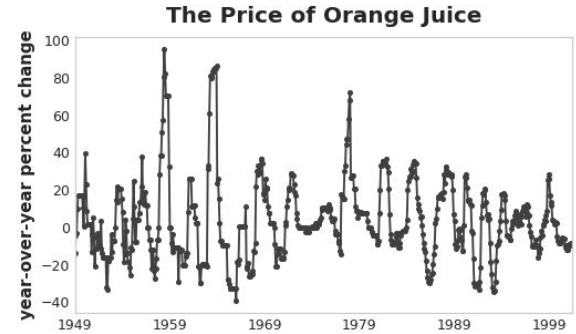
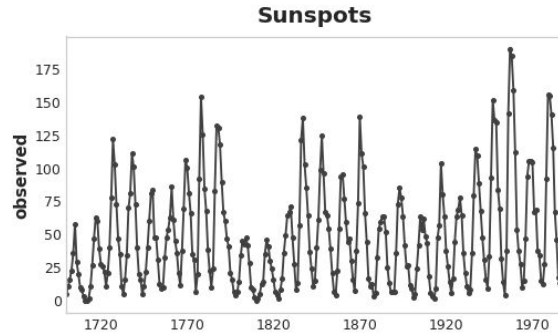
Lower energy demand



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**.

