Smart Meters Being Connected

An Internet of Things initiative to help consumers and energy companies save energy

Project Description

Abstract

With meter data analytics, utilities are recognizing the true value of their Smart Grid investment: Data. Smart Meter Analytics enables the utility industry to help consumers understand their usage patterns and billing, manage power quality, improve real-time power management and plan for future usage.

Problem Statement

How do we manage demand during peak season? Identify energy usage segments and forecast consumption to enable energy companies to target high usage and manage supply-demand more efficiently.

Benefits

1. Gives utilities the advantage of identifying unique groups to effectively target.
2. Forecasting facilitates planning which helps in the analysis to make better decisions.
3. Reducing energy demand as part of demand response earns you revenue incentives to offset energy costs.

Data Understanding

Exploratory Data Analysis

The dataset is a reduced version of a UK dataset that contains the energy readings for a sample of 5,567 London Households

The below plot is the overall energy consumption across all the households from 2 years. The energy consumption has a spike for the winter seasons and sees a slow decrease from spring to again start rising as fall ends. The 2012 winter spike is higher when compared to 2013. Further analysis showed that the spike was related to weather.
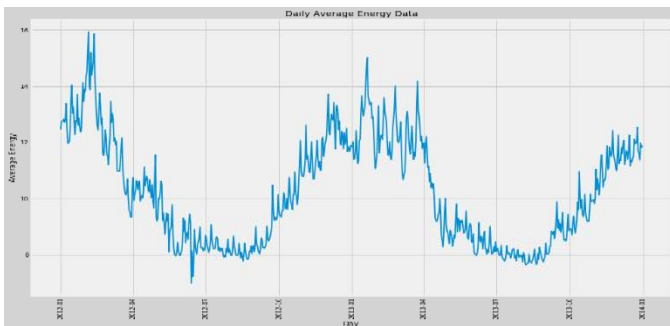

Data Model

Forecasting is a way to predict the future based on available data and understand what might and might not impact the prediction. Some of the most important concepts of time series which I will be using in my the analysis is: Trend, Seasonality, Cyclic, and Residual. ARIMA model is one of the most common models used for time series forecasts and focusses on extracting the data using autocorrelations in the data.
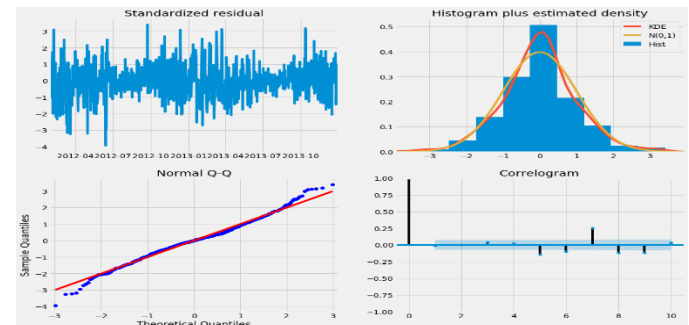
Model

1. Segment energy by usage behavior.
2. Use timeseries to make better, profitable decisions in the future.
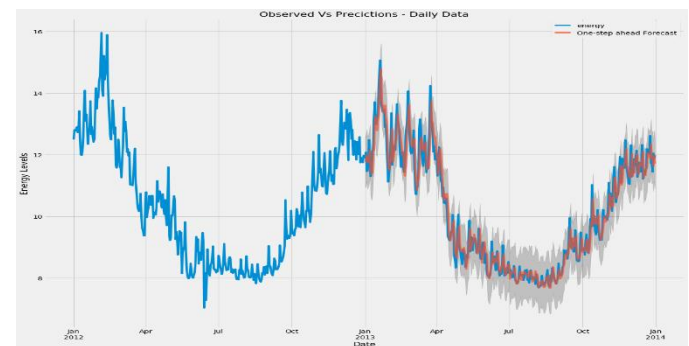
Evaluate

The residual plots should have a linear line and have a normal distribution which indicates that this is a good model.

Conclusion

To conclude this analysis, I loaded the dataset, convert it to a time series, checked whether the series was constant over time, applied statistics test to validate the stationary series, used grid search method to find optimal parameters and built a Seasonal ARIMA model, and forecasting for the next 365 days of energy consumption.

From my analysis I was able to do the below listed:
- Rising Prosperity and Affluent groups use more energy.
- Weather influences energy usage.
- Average error is at 20% which is reasonable.

Forecast to plan demand and conserve energy.

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