Electric Submeter Installation Summary Report

IOT Analytics

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Goal Summary

- Provide Additional Value to Customers by building “Smart homes” that would provide home owners with analytics to monitor and control the power usage on their own.

Overview of Dataset

- Individual power consumption data gathered between December 2006 and November 2010
- Measurement of electric power consumption in one household with one- minute sampling rate in three connected sub-meters.
- Over 2 Million instances with about 26K (1.25%) missing data .

Link for the data set - http://archive.ics.uci.edu/ml/datasets/Individual+household+electric+power+consumption

Data Analysis & Visualization

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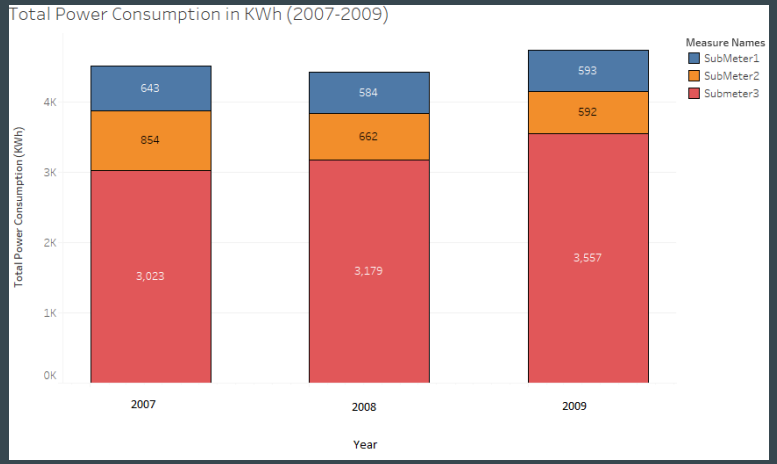
Data Analysis

Based on the Data Science framework process that was highlighted in previous session, IOT Analytics team performed a detailed analysis of the data collected from different Submeters and was able to obtain a good insight of the consumer's power consumption behavior.

<u>Overall power consumption behavior(2007-2009):</u>

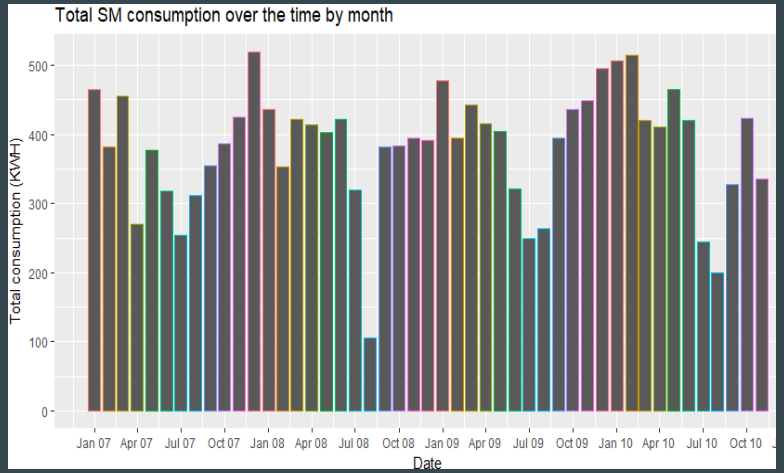
- Submeter 3 – Electric water heater and Air conditioner usage in the house hold is the highest overall through out the years and the trend looks to go upwards.
- Submeter 1 and 2 – The power consumption of various kitchen appliances and other utilities seems to go down after installation of sub meters.



Data Analysis – Cont'd

Total power consumption levels on monthly basis (2007-2010)-

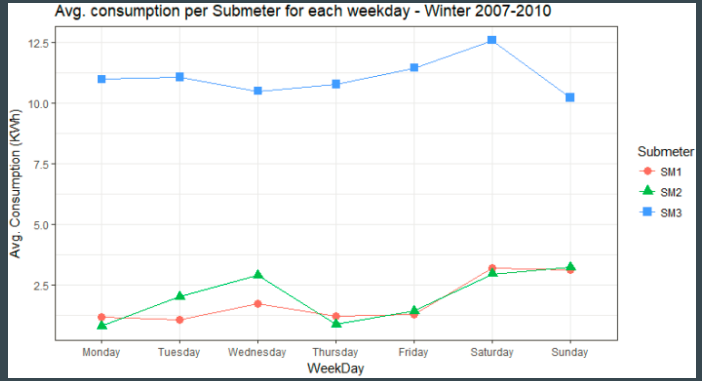
- Total Power consumption trend looks like a parabolic curve where the consumption decreases in the first 8 months (Jan-Aug) and later increases .
- July and August are the months consuming lowest power over the years .
- Power consumption is maximum during the winter months (Dec-Feb).



Data Analysis – Cont'd

Average consumption levels across all submeters on daily basis - Winter (2007-2010)

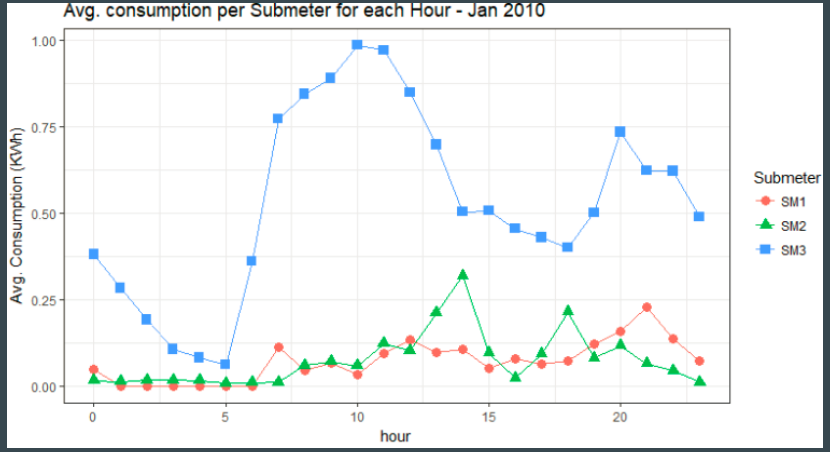
- Saturday was recorded as the highest power consumption day in all sub meters.
- Average Utilization of Kitchen appliances(Sub meter 1) and washer / dryer (Sub meter 2) were less on Monday, Thursday and Friday compared to other days during this period.
- There is a slight increase in usage of laundry room (Sub meter 2) on Wednesday, Saturday and Sunday compared to other days.



Data Analysis – Cont'd

Average consumption levels on hourly basis – January 2010

- Sub meter 3 - Average power consumption increases substantially from 5 AM and continues through 10 AM. Peak consumption is seen around 10 AM-12 PM and then continues to drop until 3 PM. Small increase in average recordings is again seen around 5:30 PM through 8PM.
- Sub meter 2 - There is an increase in the average consumption around 2-3 PM and again around 5:30- 6:30 PM. Looks like its not being used rest of the time.
- Sub meter 1 - . Small upward trend seen through out the day starting 7 AM with peak around 8- 8:30 PM.



Trend & Forecast Prediction

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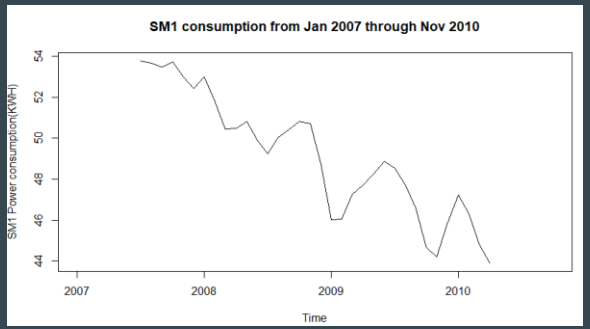
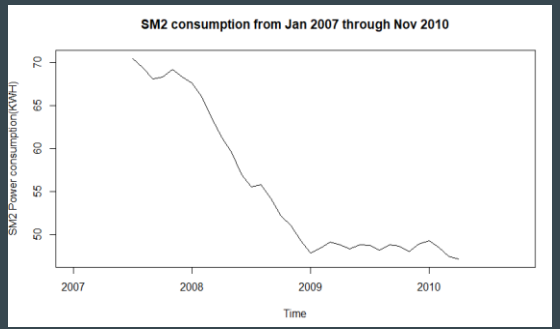
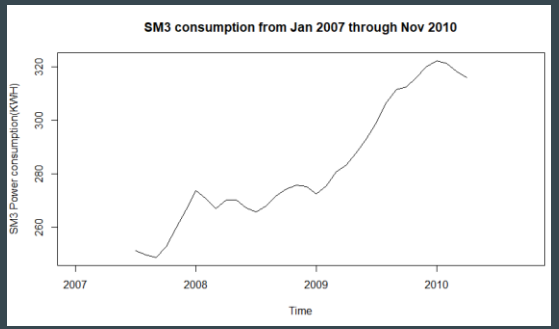
Trend

Following graphs shows overall trend of energy consumption of electric sub meters 1 , 2 and 3 from 2007 through 2010.

- The trend of Sub meter 1 (SM1) and Sub meter 2 (SM2) are seen to go downwards over time.
- Sub meter 3 (SM3) consumption continues to move upward over years.

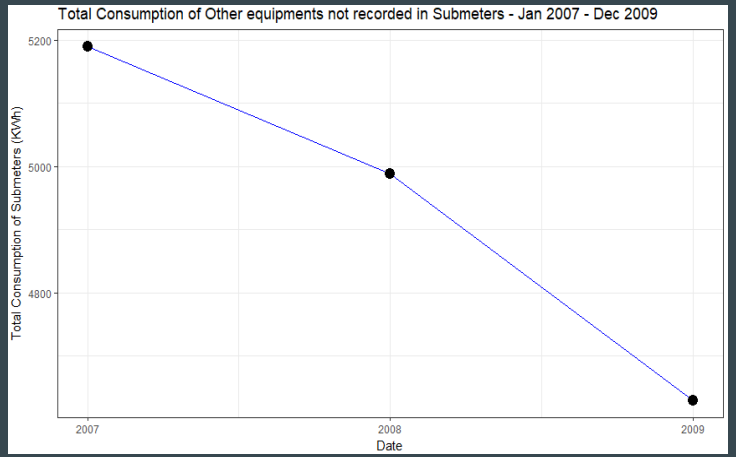






Trend– cont’d

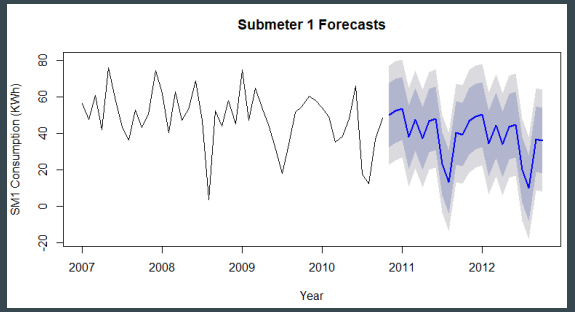
• Total power consumption in the household by electrical equipment that was not measured in sub meters 1 , 2 and 3 had also come down after installation of electric sub meters.

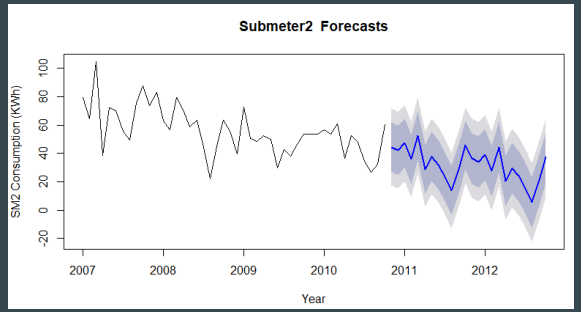


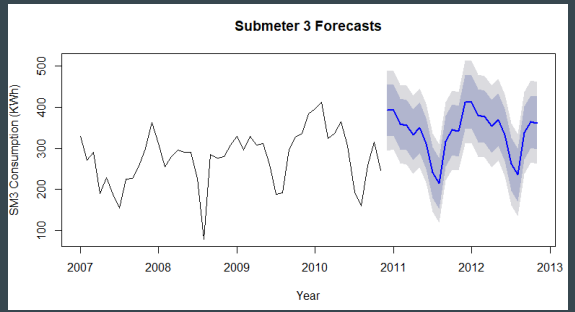
Forecast

Following charts showcases the forecast of total power consumption of Submeters 1 ,2 and 3 over the next 2 years.

- Submeter 1 and 2 had a decreasing trend as seen in the previous slide and the forecasts is also seen to go down a bit where as forecast for sub meter 3 consumption is set to increase further over the next couple of years.
- Forecasts for 2011 and 2012 are plotted as blue line , the 80% prediction interval as dark gray shaded area and 95% prediction interval as light gray shaded area.







Summary & Recommendations

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Summary

- Total power consumption reading in sub meters seems to increase over time after installation of sub meters and the primary reason for it is because of the higher power consumption by equipments as part of sub meter 3 which are electric heater and air conditioner. Sub meter 1 and 2 are under control.
- At least 75% of the overall consumption is by AC & Water Heater.
- Power Usage is highly dependent on seasonality.

Recommendations

I strongly believe that these sub meters play an important role in the longer run and gives a better control over the usage of appliances/ devices in a household. This granular level of data can also be analyzed periodically to review any anomaly in the power consumption recordings in a household.

Following are some of the key points that can be considered to help optimize the sub meter 3 readings -

- Electric Heater and Air Conditioner which are being recorded in 'Sub Meter 3' needs to be checked for maintenance. This is because the power consumption of these equipments are constantly increasing over time .
- Thermal Insulation of the house needs to be cross checked to make sure the heat is being retained properly during Winter season.
- Check with the household members and understand their air conditioner and electric heater usage patterns on Saturday compared to Sunday since the usage of these equipments on Sunday is less than that of Saturday .
- Since the average usage of electric heater and air conditioner in the house hold is lowest on Sunday, we can check with the household member to move some of their cooking / washing activities from Saturday to Sunday to any avoid peak charges.
- Cross check whether the Air conditioner/ Heater settings in the household are set at optimum values even though there is no one present at home.

Questions?

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