**Residential Electric Power Usage Report**

For this project we were analyzing the residential electric power usage from 2007-2010. We were asked by a large residential developer to extract any useful data that will help in deciding in whether to adopt the use of electrical sub-metering devices used for power management in Smart Homes. Sub Meters have been a popular tool in power usage analytics and the developer is also looking for possibilities to predict future power usage based on the data provided. The attributes contained in the dataset were “id" , "Date", "Time", "Global active power" "Global reactive power" "Global intensity" , "Voltage", "Sub\_metering\_1" ,"Sub\_metering\_2" , and "Sub\_metering\_3".

To analyze the data and to answer the questions for a developer, we chose to work with the following attributes: "Date", "Time", "Sub\_metering\_1" ,"Sub\_metering\_2" , and "Sub\_metering\_3".

Sub\_metering\_1- corresponds to the kitchen, containing mainly a dishwasher, an oven and a microwave (hot plates are not electric but gas powered).

Sub\_metering\_2 - corresponds to the laundry room, containing a washing-machine, a tumble-dryer, a refrigerator and a light.

Sub\_metering\_3- corresponds to an electric water-heater and an air-conditioner.

All 3 sub meters are measured in watt-hours of active energy.

While analyzing the data we found that not each data frame covers the entire year. Please find below the coverage of the data for each year:

Start End

2006: 12-16 17:24:00 12-31 23:59:00

2007: 01-01 00:00:00 12-31 23:59:00

2008: 01-01 00:00:00 12-31 23:59:00

2009: 01-01 00:00:00 12-31 23:59:00

2010: 01-01 00:00:00 11-26 21:02:00

From the information above we see that for the year 2006 we have power usage only for the second part of the month of December. Also, for the year 2010 the power usage information stops on November 26th.

Looking at the descriptive statistics of the data by year, we can see that the average for sub\_meter 1 and 2 in 2007 is slightly higher than for the years 2008-2010, while the average for sub\_meter 3 for year 2006 is slightly lower than for the same sub\_meter for the years 2008-2010. If we look at the maximum usage of each sub­\_meter by year we can see that the maximum usage of energy is the highest for 2010 for sub\_meter 1 and 2 if to compare it with years 2009-2010. For sub\_meter 3 for the year 2010 the maximum usage of energy was the same as for the years 2008-2009, and for the year of 2007 the usage of sub\_meter 3 was the lowest at just 20 watt-hours of active energy. Please, find the descriptive statistics below:

2007:

Mean: 1.232 Mean: 1.638 Mean: 5.795

3rd Qu.: 0.000 3rd Qu.: 1.000 3rd Qu.:17.000

Max.: 78.000 Max.: 78.000 Max.: 20.000

2008:

Mean: 1.11 Mean: 1.256 Mean: 6.034

3rd Qu.: 0.00 3rd Qu.: 1.000 3rd Qu.:17.000

Max.: 80.00 Max. :76.000 Max.: 31.000

2009:

Mean: 1.137 Mean: 1.136 Mean: 6.823

3rd Qu.: 0.000 3rd Qu.: 1.000 3rd Qu.:18.000

Max.: 82.000 Max.: 77.000 Max.: 31.000

2010:

Mean: 0.9875 Mean: 1.102 Mean: 7.244

3rd Qu.: 0.0000 3rd Qu.: 1.000 3rd Qu.:18.000

Max.: 88.0000 Max.: 80.000 Max.: 31.000

Looking at the information above it is hard to make any conclusion on the patterns of the data and any useful recommendations for the future usage of submeters in smart homes. First, we will need to work more with the data and look at the monthly, weekly, and possibly daily usage of power. Second, it will be useful to look at the usage of power by season, since the usage of power is different in colder and hotter months verse spring and fall months. Also, it will be useful to know the geographical location of the data that we are dealing with. If we see any outliers we need to look at the weather abnormalities in the past and see if we can explain it. For example, was there a heat wave during the summer, or long cold spells during the winter? Third, we would recommend looking closer at submeter 3 since A/Cs and Water heaters consume different amounts of energy. Splitting the sub- meters will create a better overall picture of energy use. We need to look at the possibility using solar panels for water heaters and maybe even A/Cs in smart homes as well.