Analysis - Visualizations

Code

libraries

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```
library(ggplot2)
```

Energy over Time for each Submeter (and Frequency)

Submeter 1

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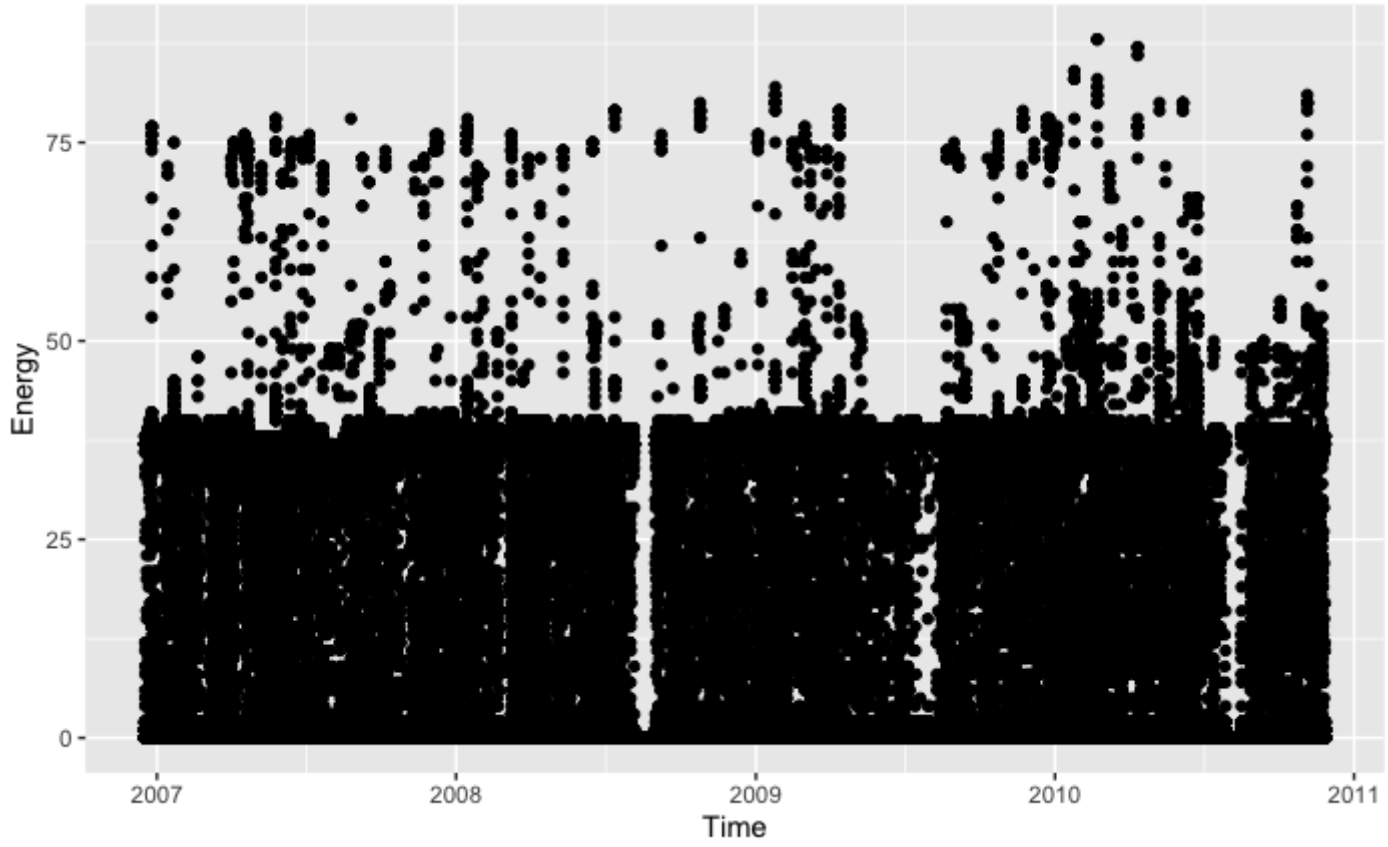
```
# Submeter 1 Over Time
ggplot(data=df2006_2010, aes(x=DateTime, y=Sub_metering_1)) + geom_point()+ylab("Energy"
)+ xlab("Time")
```



Most observations are between 0 and 40, with occassional high usage. There are two primary breaks in the data, where there is minimum usage. Perhaps, this is vacation time.

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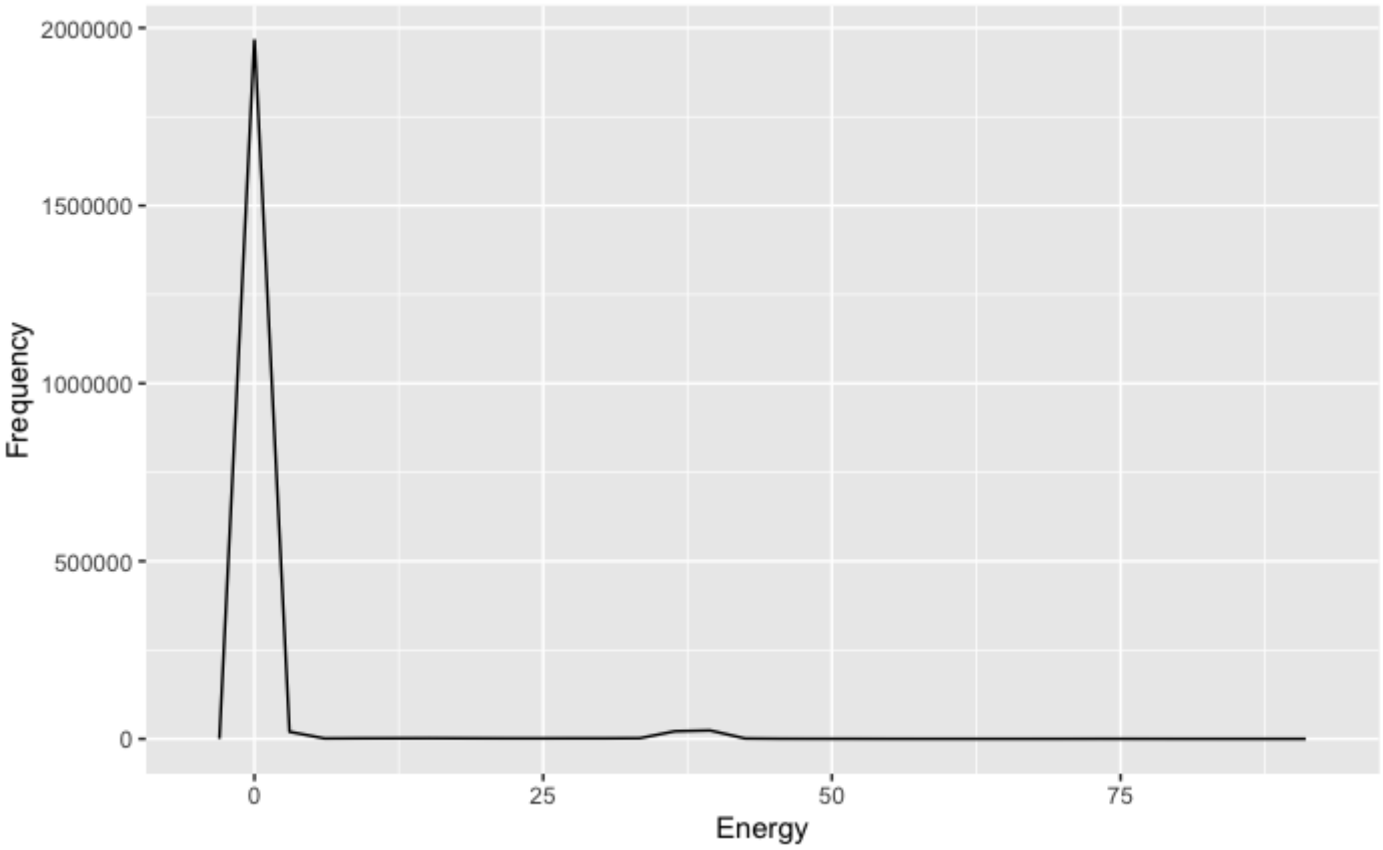
```
# Frequency Plot
ggplot(data=df2006_2010, aes(x=Sub_metering_1)) + geom_freqpoly()+ylab("Frequency")+ xla
b("Energy")
```



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```
# Frequency Table for Submeter 1
frequency_submeter1 <- data.frame(table(df2006_2010$Sub_metering_1))
names(frequency_submeter1)[names(frequency_submeter1) == "Var1"] <- "Energy"
names(frequency_submeter1)[names(frequency_submeter1) == "Freq"] <- "Frequency"
arrange(frequency_submeter1, -frequency_submeter1$Frequency)
```

Energy <fctr>	**Frequency** <int>
0	1880175
1	84936
2	19017
38	16119
37	14892

Energy <fctr>	Frequency <int>
39	6503
36	5270
35	1359
40	1159
32	802

1-10 of 88 rows Previous **1** 2 3 4 5 6 ... 9 Next

Submeter 2

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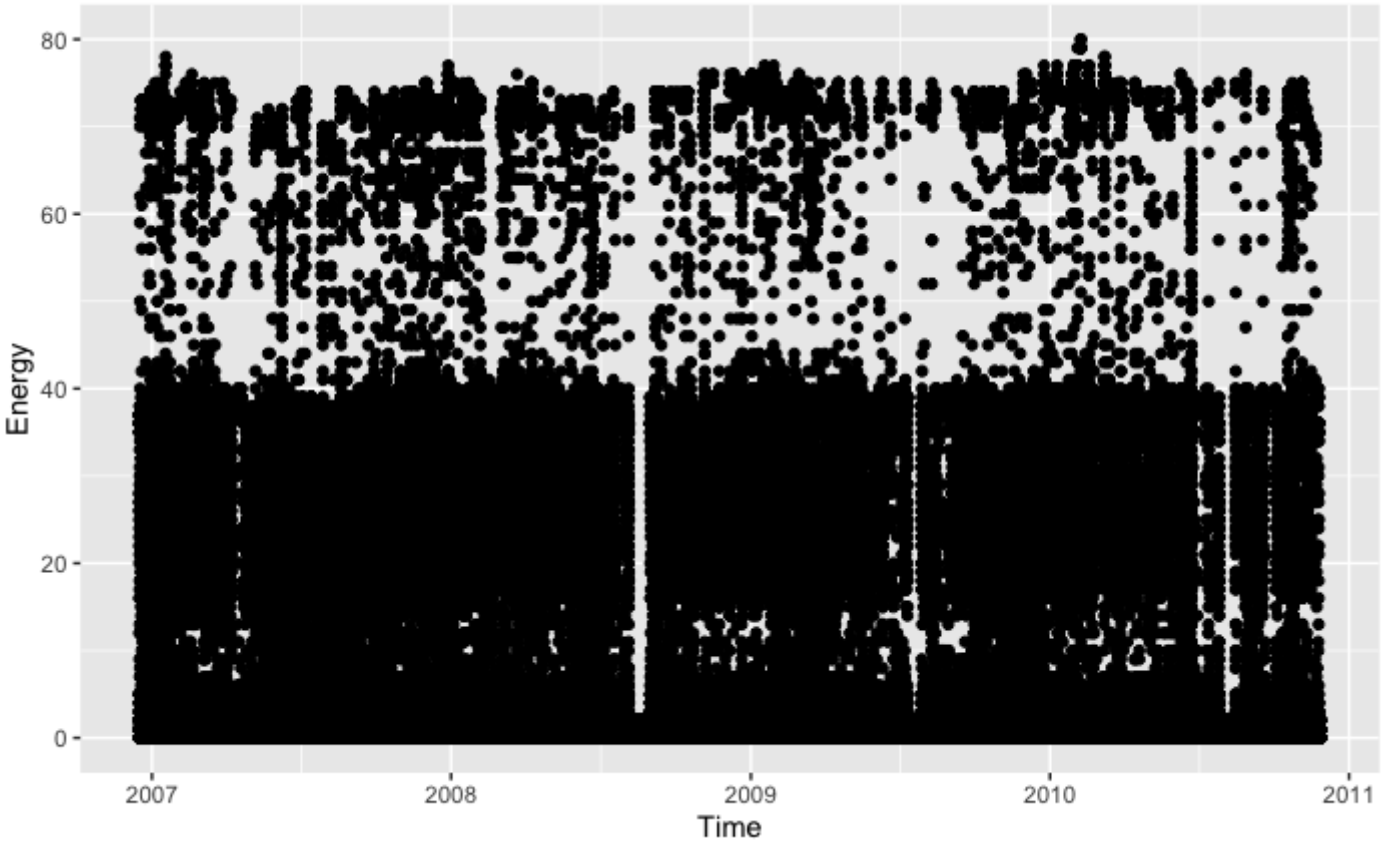
```
# Submeter 2 Over Time
ggplot(data=df2006_2010, aes(x=DateTime, y=Sub_metering_2)) + geom_point()+ylab("Energy"
)+ xlab("Time")
```



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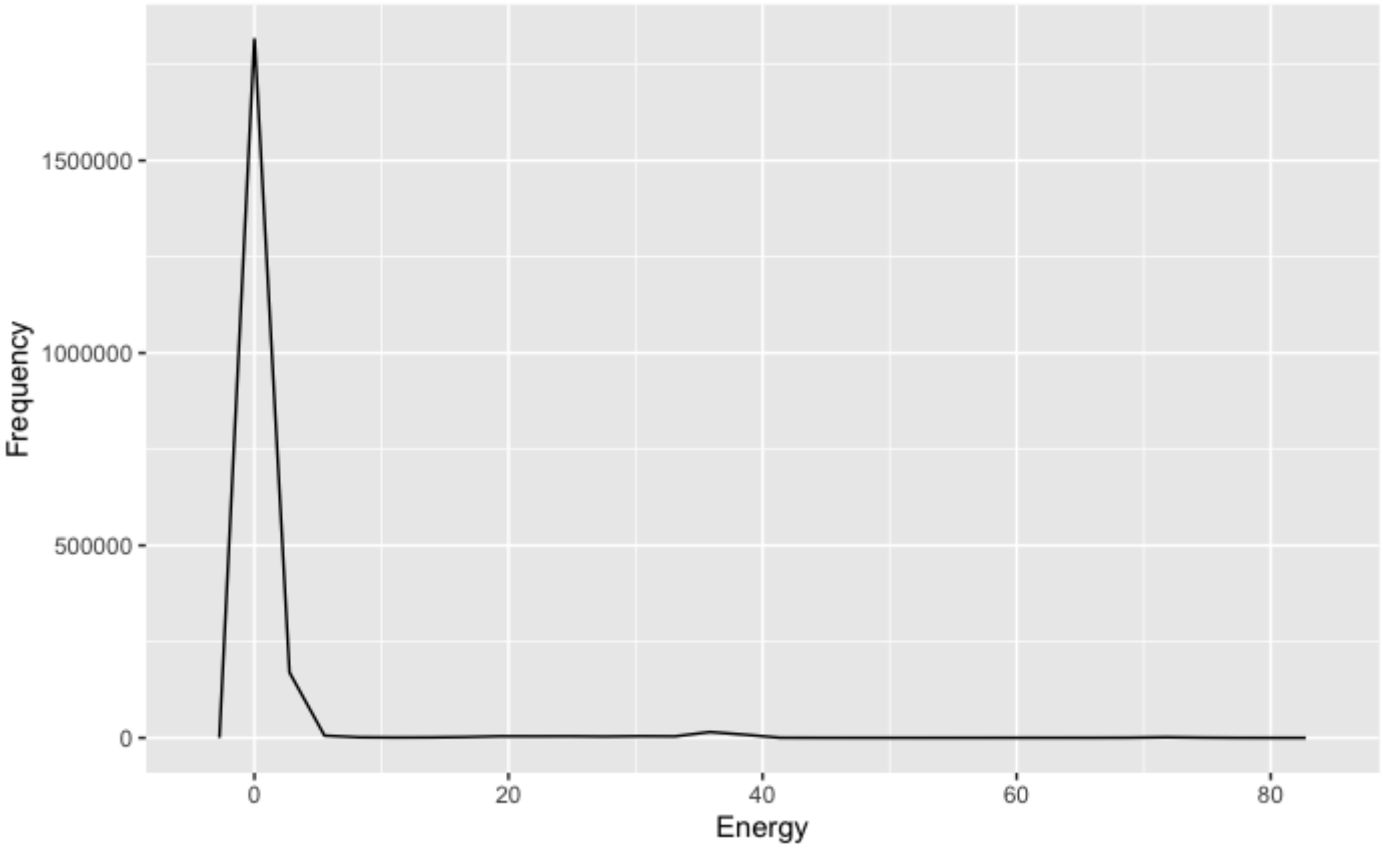
```
# Frequency
ggplot(data=df2006_2010, aes(x=Sub_metering_2)) + geom_freqpoly()+ylab("Frequency")+ xla
b("Energy")
```



Submeter 3

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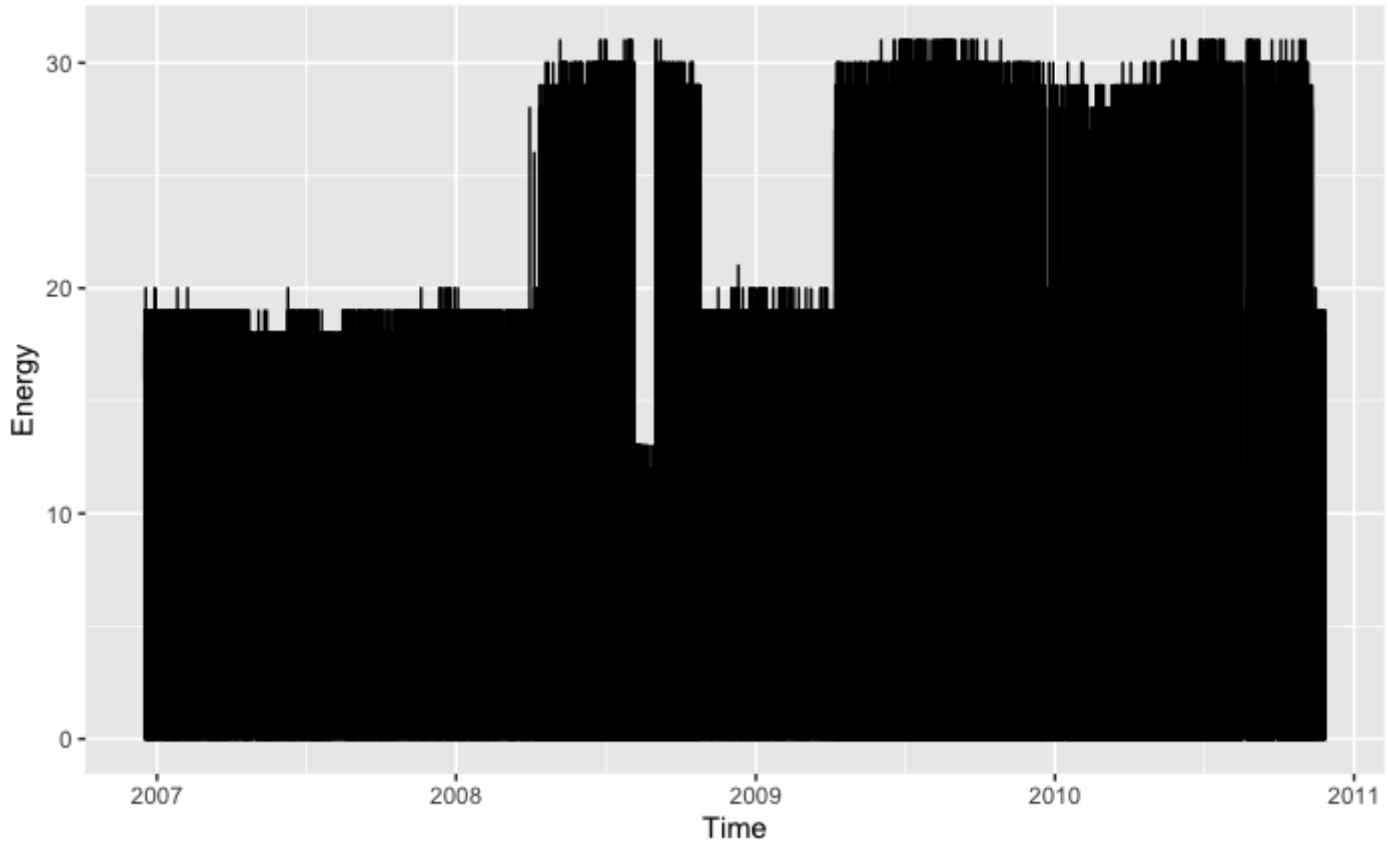
```
# Submeter 2 Over Time
ggplot(data=df2006_2010, aes(x=DateTime, y=Sub_metering_3)) + geom_line()+ylab("Energy")
+ xlab("Time")
```



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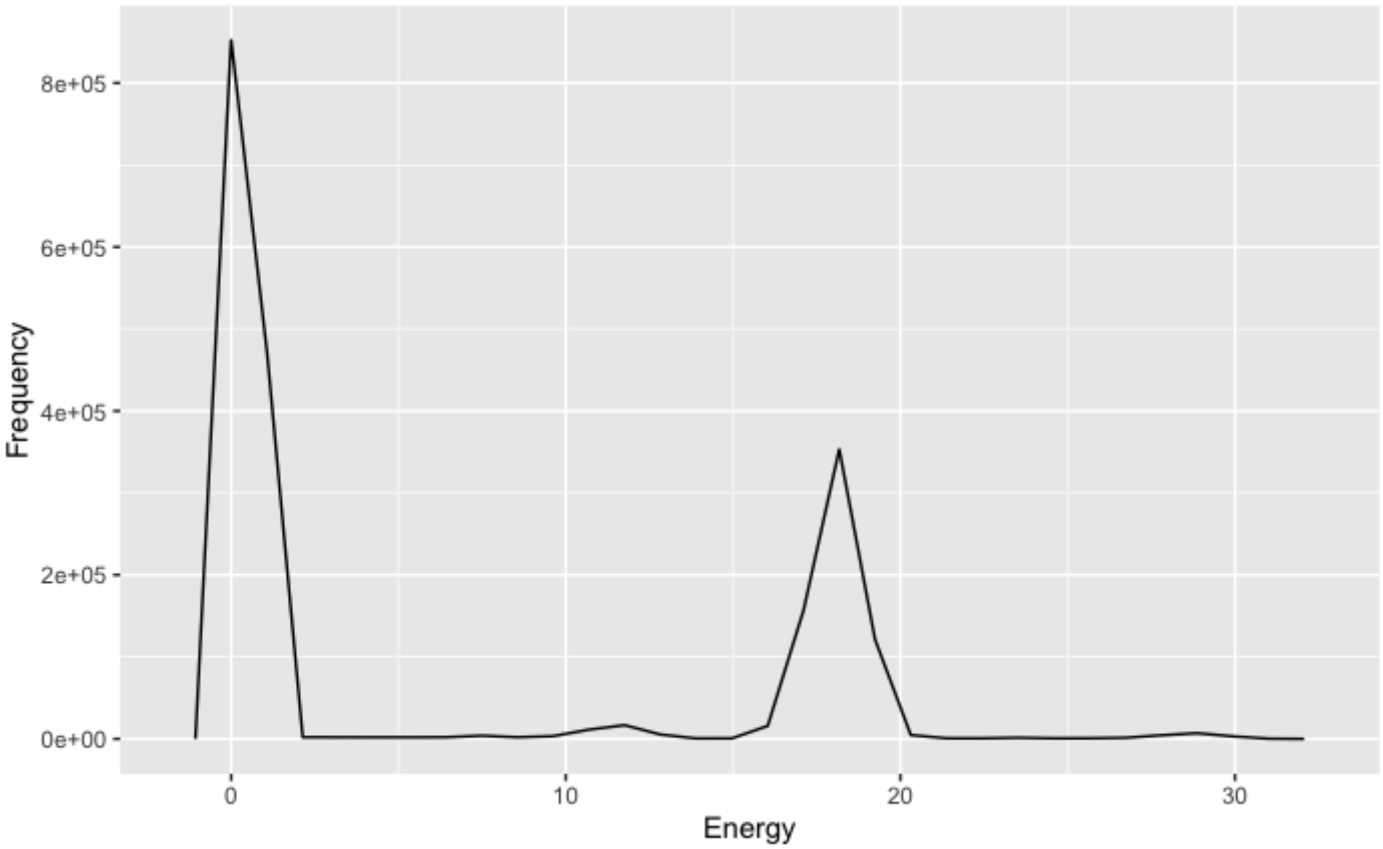
```
# Frequency
ggplot(data=df2006_2010, aes(x=Sub_metering_3)) + geom_freqpoly()+ylab("Frequency")+ xla
b("Energy")
```



Total Energy Consumption for Each Submeter

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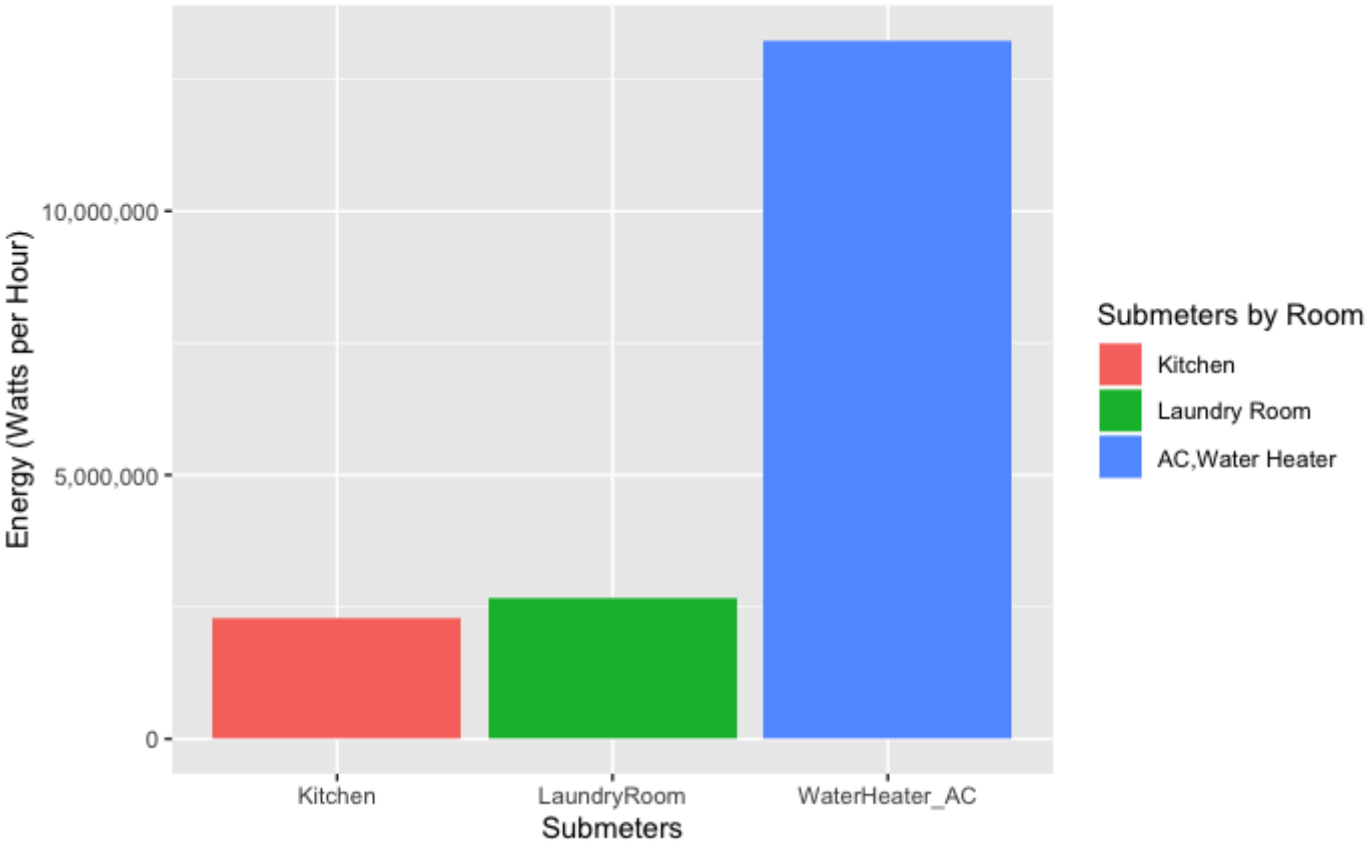
```
# Plot
ggplot(data = sum_of_submeters_long, aes(x = Submeters, y = Total_Energy_Usage, fill = S
ubmeters)) +
    geom_col()+
   scale_y_continuous(label=comma)+
   ylab("Energy (Watts per Hour)")+
   scale_fill_discrete(name = "Submeters by Room", labels = c("Kitchen", "Laundry Room",
"AC,Water Heater"))
```



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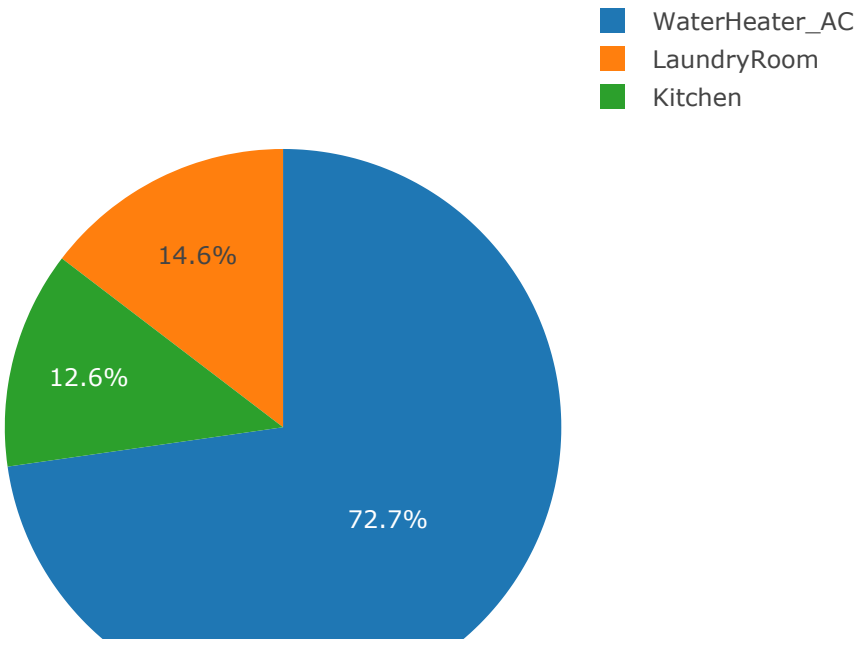
```
# pie chart of total usage
plot_ly(sum_of_submeters_long, labels = ~Submeters, values = ~Total_Energy_Usage, type =
'pie') %>%
  layout(title = '',
         xaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabels = FALSE),
         yaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabels = FALSE))
```



Exploring Different Intervals in 2008

Which time interval is best for addressing granularity?

Day of January 9, 2008

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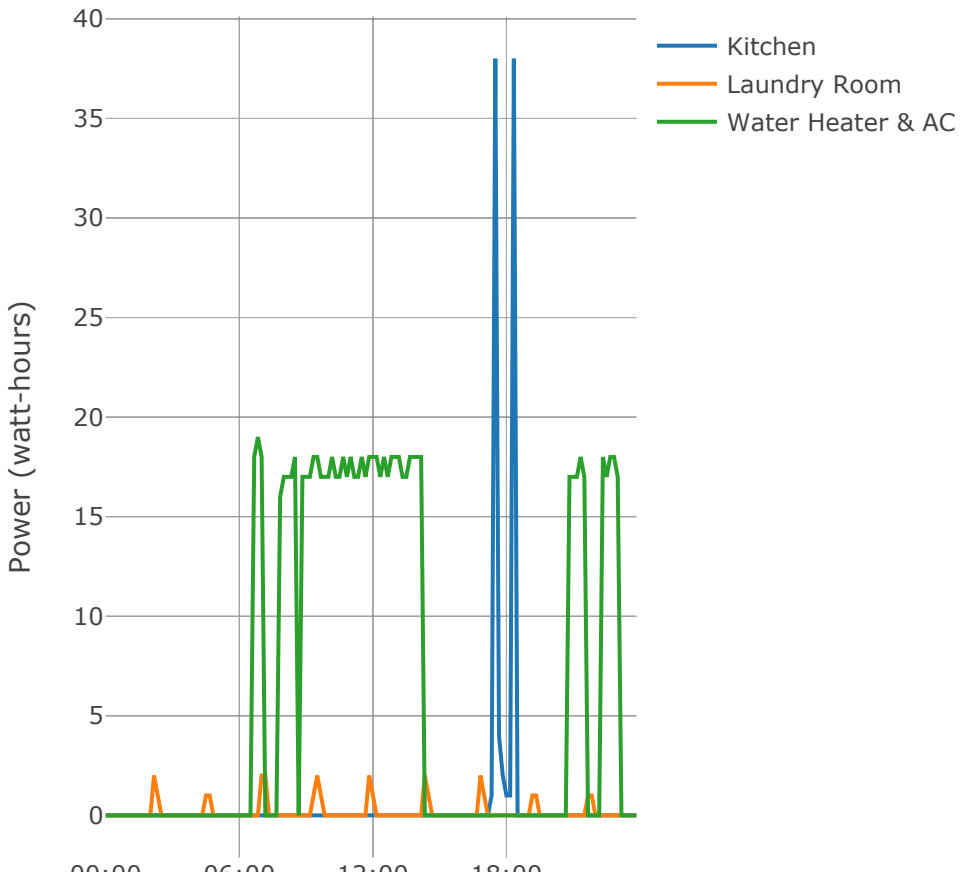
```
## Plot 2008/01/08- Submeters, 10-minute Frequencies
plot_ly(houseDay20080109_10min, x = ~houseDay20080109_10min$DateTime, y = ~houseDay20080
109_10min$Sub_metering_1, name = 'Kitchen', type = 'scatter', mode = 'lines') %>%
 add_trace(y = ~houseDay20080109_10min$Sub_metering_2, name = 'Laundry Room', mode = 'li
nes') %>%
 add_trace(y = ~houseDay20080109_10min$Sub_metering_3, name = 'Water Heater & AC', mode
 = 'lines') %>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))
```



Christmas Week, 2008

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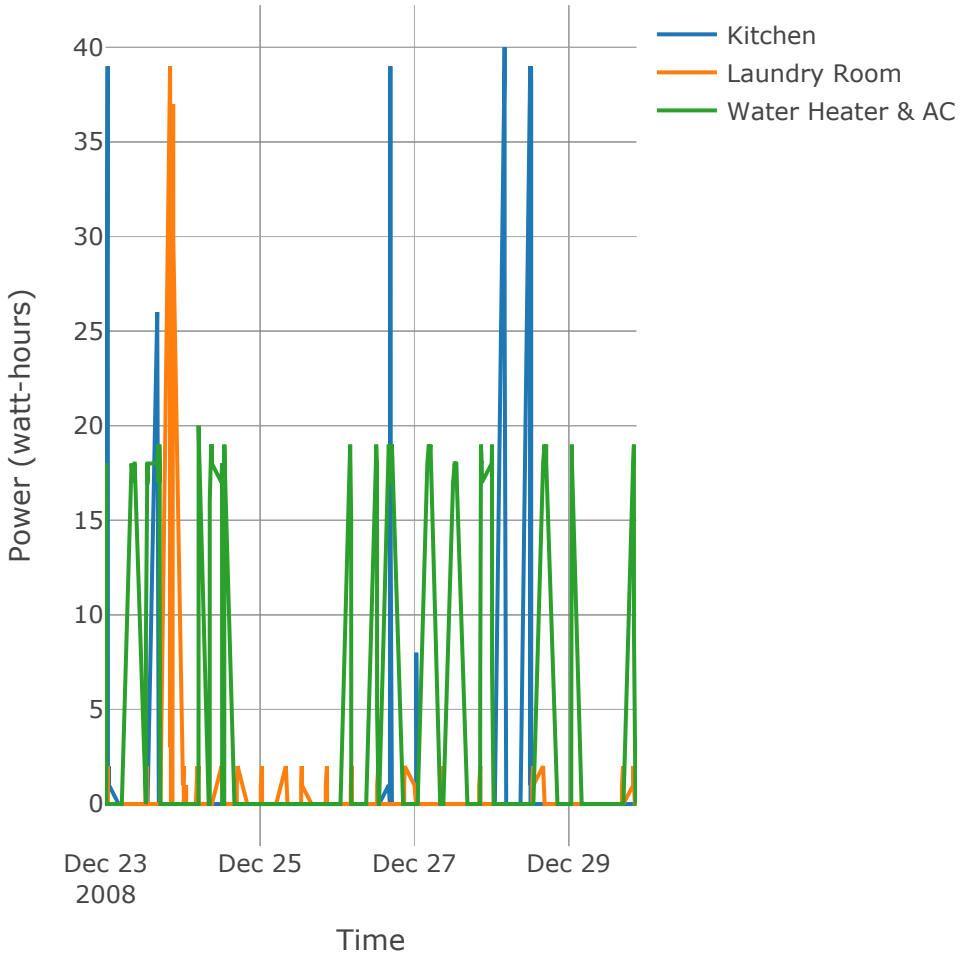
```
#Plot Week 52 in 2008, every 4 hours
plot_ly(week52_2018_4hours, x = week52_2018_4hours$DateTime, y = ~week52_2018_4hours$Sub
_metering_1, name = 'Kitchen', type = 'scatter', mode = 'lines') %>%
 add_trace(y = ~week52_2018_4hours$Sub_metering_2, name = 'Laundry Room', mode = 'lines'
) %>%
 add_trace(y = ~week52_2018_4hours$Sub_metering_3, name = 'Water Heater & AC', mode = 'l
ines') %>%
 layout( xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))
```



Weekdays in 2008

Thursdays

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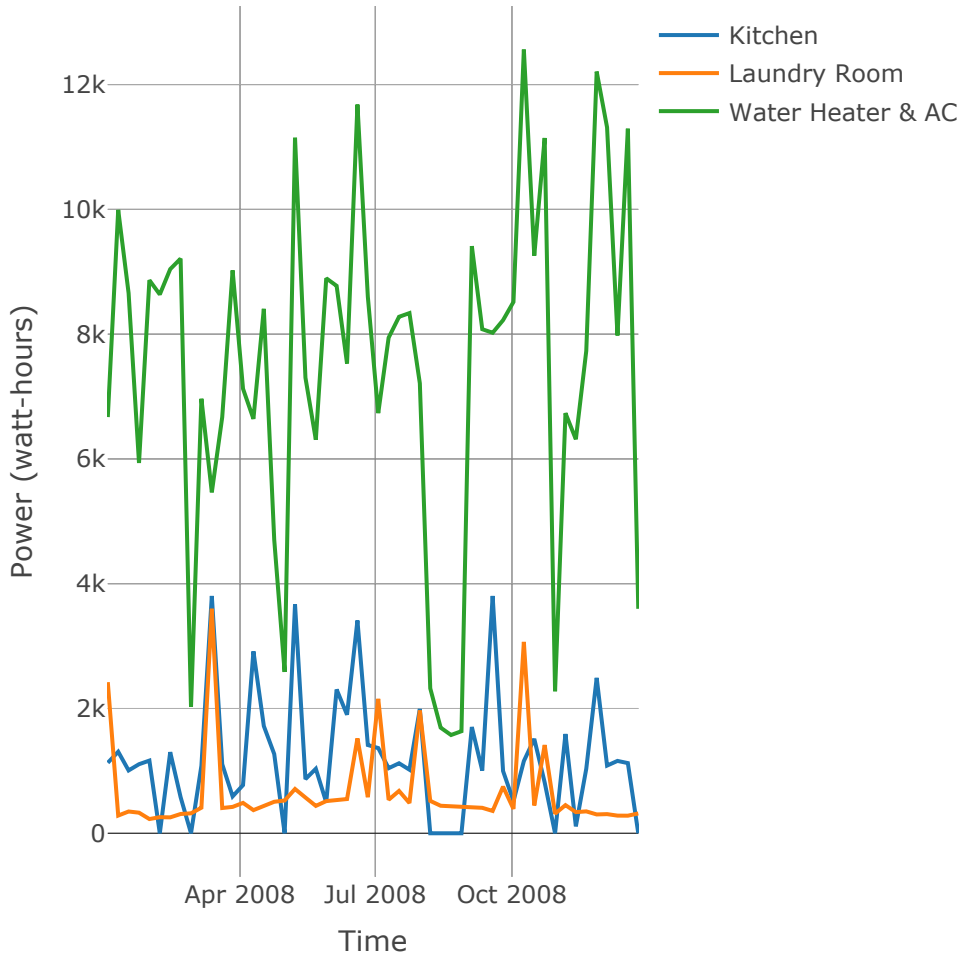
```
#Plot Thursdays in 2008
plot_ly(thursdays08, x = thursdays08$date, y = ~thursdays08$Kitchen, name = 'Kitchen', t
ype = 'scatter', mode = 'lines') %>%
 add_trace(y = ~thursdays08$LaundryRoom, name = 'Laundry Room', mode = 'lines') %>%
 add_trace(y = ~thursdays08$WaterHeaterAC, name = 'Water Heater & AC', mode = 'lines') %
>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))
```



sundays

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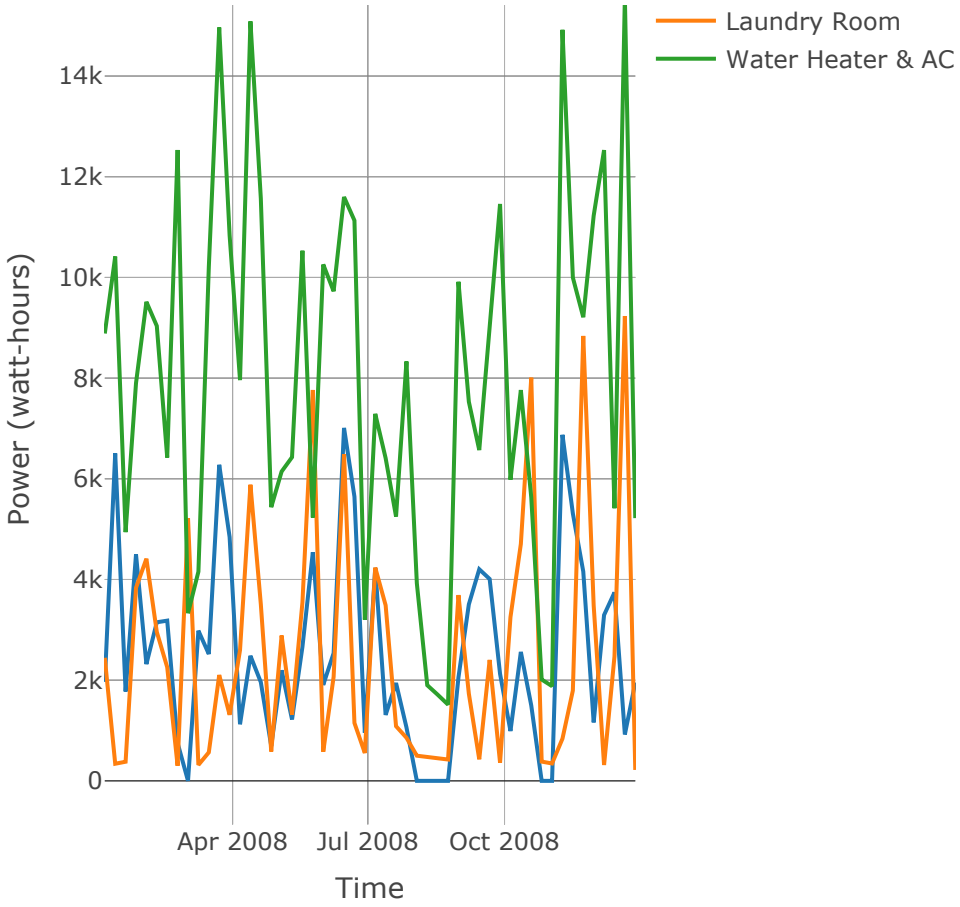
```
#Plot sundays in 2008
plot_ly(sundays08, x = sundays08$date, y = ~sundays08$Kitchen, name = 'Kitchen', type =
'scatter', mode = 'lines') %>%
 add_trace(y = ~sundays08$LaundryRoom, name = 'Laundry Room', mode = 'lines') %>%
 add_trace(y = ~sundays08$WaterHeaterAC, name = 'Water Heater & AC', mode = 'lines') %>%
 layout( xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))
```



Weekdays All Years

Submeter 1

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```
#make individual weekday plots for Submeter 1
mondays1_plot <- plot_ly(mondays, x = mondays$date, y = ~mondays$Kitchen, name = 'monday
s', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))

tuesdays1_plot <- plot_ly(tuesdays, x = tuesdays$date, y = ~tuesdays$Kitchen, name = 'tu
esdays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))

wednesdays1_plot <- plot_ly(wednesdays, x = wednesdays$date, y = ~wednesdays$Kitchen, na
me = 'wednesdays', type = 'scatter', mode = 'lines') %>%
  layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))

thursdays1_plot <- plot_ly(thursdays, x = thursdays$date, y = ~thursdays$Kitchen, name =
'Thursdays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))

fridays1_plot <- plot_ly(fridays, x = fridays$date, y = ~fridays$Kitchen, name = 'friday
s', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))

saturdays1_plot <- plot_ly(saturdays, x = saturdays$date, y = ~saturdays$Kitchen, name =
'saturdays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))

sundays1_plot <- plot_ly(sundays, x = sundays$date, y = ~sundays$Kitchen, name = 'sunday
s', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))
```

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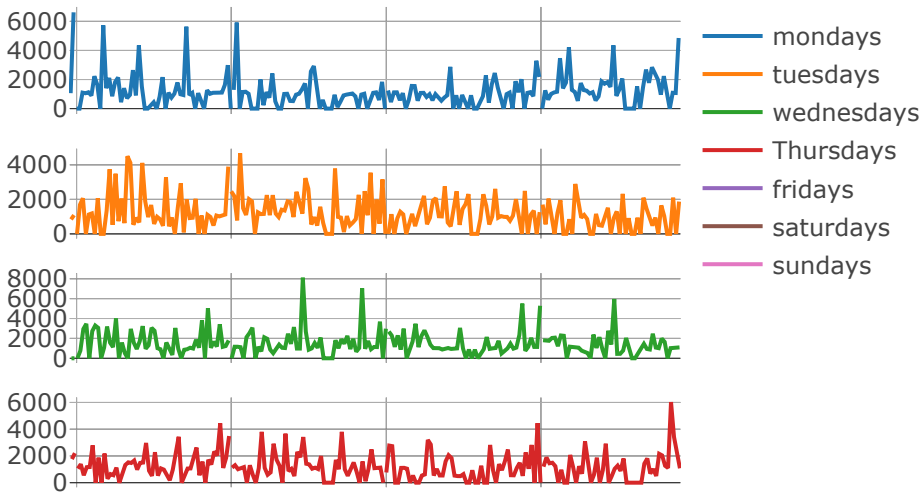
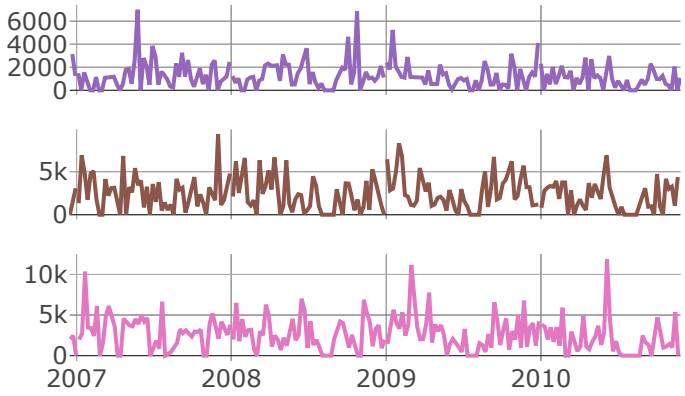
```
weekdays_plot_kitchen <- subplot(mondays1_plot, tuesdays1_plot, wednesdays1_plot, thursd
ays1_plot, fridays1_plot, saturdays1_plot, sundays1_plot, nrows =7, shareX = TRUE, share
Y = TRUE, titleY = FALSE, titleX = FALSE)

weekdays_plot_kitchen
```





Submeter 2

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```
#make individual weekday plots for Submeter 2
mondays2_plot <- plot_ly(mondays, x = mondays$date, y = ~mondays$LaundryRoom, name = 'mo
ndays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))

tuesdays2_plot <- plot_ly(tuesdays, x = tuesdays$date, y = ~tuesdays$LaundryRoom, name =
'tuesdays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))

wednesdays2_plot <- plot_ly(wednesdays, x = wednesdays$date, y = ~wednesdays$LaundryRoo
m, name = 'wednesdays', type = 'scatter', mode = 'lines') %>%
  layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))

thursdays2_plot <- plot_ly(thursdays, x = thursdays$date, y = ~thursdays$LaundryRoom, na
me = 'Thursdays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))

fridays2_plot <- plot_ly(fridays, x = fridays$date, y = ~fridays$LaundryRoom, name = 'fr
idays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))

saturdays2_plot <- plot_ly(saturdays, x = saturdays$date, y = ~saturdays$LaundryRoom, na
me = 'saturdays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))

sundays2_plot <- plot_ly(sundays, x = sundays$date, y = ~sundays$LaundryRoom, name = 'su
ndays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))
```

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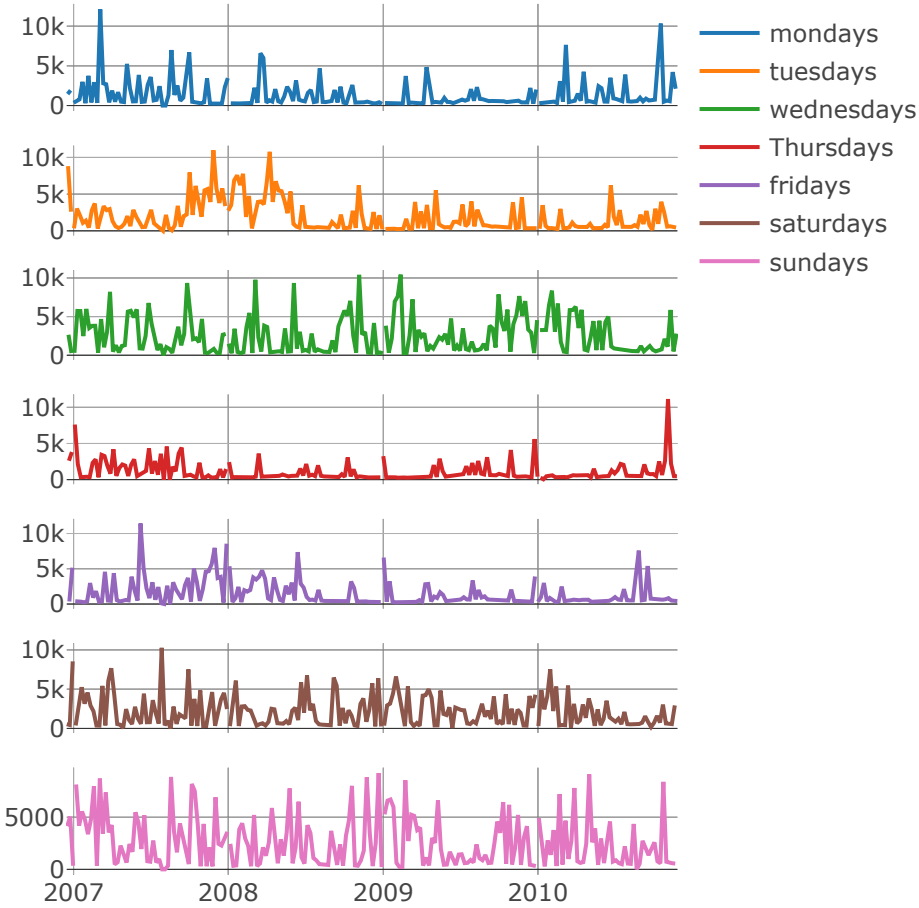
```
weekdays_plot_LaundryRoom <- subplot(mondays2_plot, tuesdays2_plot, wednesdays2_plot, th
ursdays2_plot, fridays2_plot, saturdays2_plot, sundays2_plot, nrows =7, shareX = TRUE, s
hareY = TRUE, titleY = FALSE, titleX = FALSE)

weekdays_plot_LaundryRoom
```



Submeter 3

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```
#make individual weekday plots for Submeter 3
mondays3_plot <- plot_ly(mondays, x = mondays$date, y = ~mondays$WaterHeaterAC, name =
'mondays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))

tuesdays3_plot <- plot_ly(tuesdays, x = tuesdays$date, y = ~tuesdays$WaterHeaterAC, name
= 'tuesdays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))

wednesdays3_plot <- plot_ly(wednesdays, x = wednesdays$date, y = ~wednesdays$WaterHeater
AC, name = 'wednesdays', type = 'scatter', mode = 'lines') %>%
  layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))

thursdays3_plot <- plot_ly(thursdays, x = thursdays$date, y = ~thursdays$WaterHeaterAC,
 name = 'Thursdays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))

fridays3_plot <- plot_ly(fridays, x = fridays$date, y = ~fridays$WaterHeaterAC, name =
'fridays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))

saturdays3_plot <- plot_ly(saturdays, x = saturdays$date, y = ~saturdays$WaterHeaterAC,
 name = 'saturdays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"), yaxis = list (title = "Power (watt-hours)"))

sundays3_plot <- plot_ly(sundays, x = sundays$date, y = ~sundays$WaterHeaterAC, name =
'sundays', type = 'scatter', mode = 'lines') %>%
 layout(xaxis = list(title = "Time"),yaxis = list (title = "Power (watt-hours)"))
```

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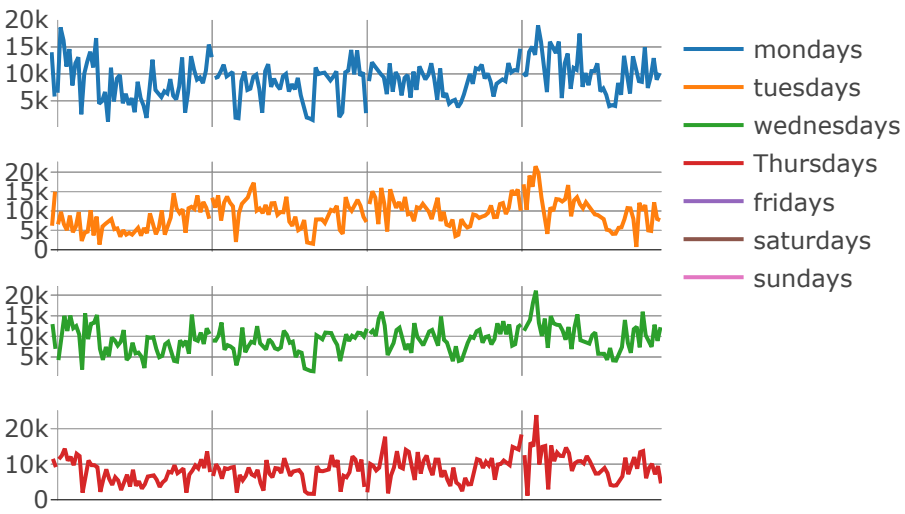
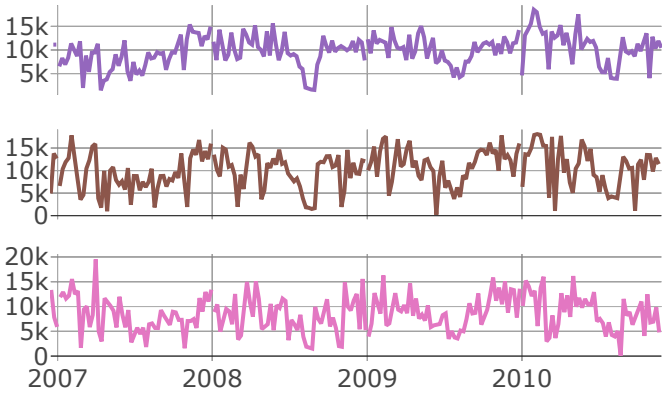
```
weekdays_plot_WaterHeaterAC <- subplot(mondays3_plot, tuesdays3_plot, wednesdays3_plot,
thursdays3_plot, fridays3_plot, saturdays3_plot, sundays3_plot, nrows =7, shareX = TRUE,
shareY = TRUE, titleY = FALSE, titleX = FALSE)

weekdays_plot_WaterHeaterAC
```





Time of Day Visualizations

Total Usage by Time of Day

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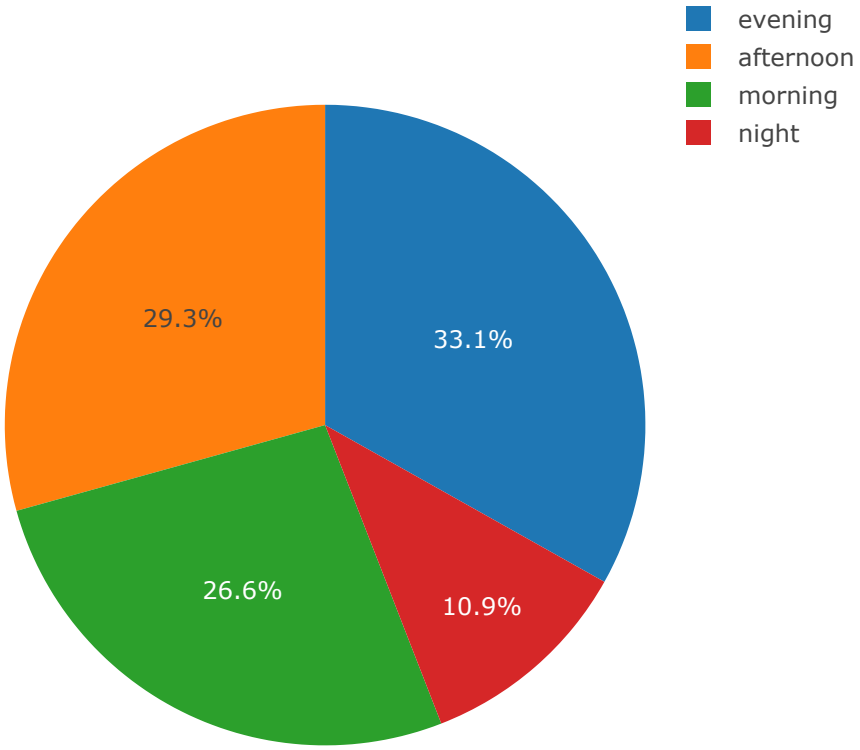
```
# pie chart "TimeOfDay Total Usage"
plot_ly(allYearsTimeofDayTotals, labels = ~timeOfDay, values = ~totalEnergy, type = 'pi
e') %>%
  layout(title = '',
         xaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabels = FALSE),
         yaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabels = FALSE))
```



Total Usage by Time of Day, and Submeter

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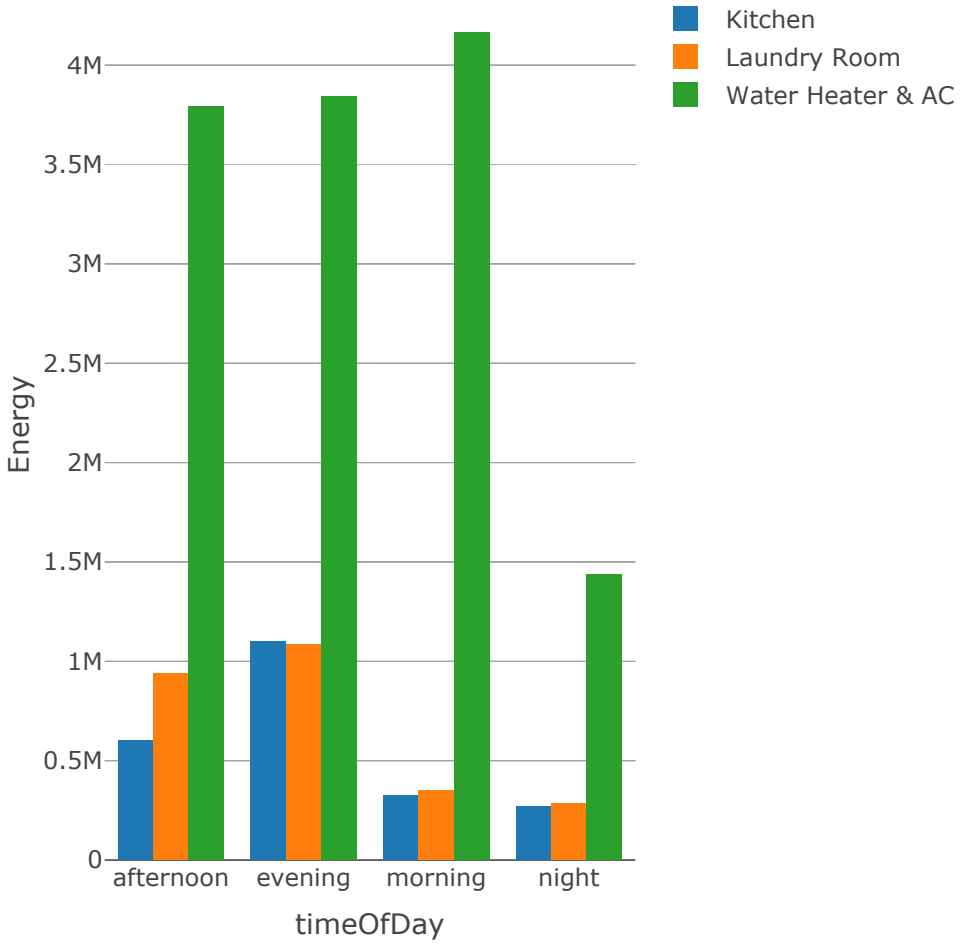
```
# bar chart for Time of Day, Total Usage, by each submeter
plot_ly(allYearsTimeofDayTotals, x = ~timeOfDay, y = ~Kitchen, type = 'bar', name = 'Kit
chen') %>%
  add_trace(y = ~LaundryRoom, name = 'Laundry Room') %>%
  add_trace(y = ~WaterHeaterAC, name = 'Water Heater & AC') %>%
  layout(yaxis = list(title = 'Energy'), barmode = 'group')
```



Total Usage by Weekday

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```
# View dataframe for weekday, 2006-2010, Sum of All Usage
weekdaysAllYearsTotals
```

weekday <fctr>	Kitchen <dbl>	LaundryRoom <dbl>	WaterHeaterAC <dbl>	totalEnergy <dbl>
Friday	254548	299050	2021938	2575536
Monday	235899	265556	1842356	2343811
Saturday	490027	433751	2098915	3022693
Sunday	530394	536137	1739338	2805869
Thursday	244990	220302	1760543	2225835
Tuesday	243890	386935	1896362	2527187
Wednesday	299387	519300	1875715	2694402

7 rows

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```
# Reorder Weekday column
weekdaysAllYearsTotals$weekday <- factor(weekdaysAllYearsTotals$weekday, levels = c("Mon
day","Tuesday","Wednesday","Thursday","Friday","Saturday","Sunday"))
```

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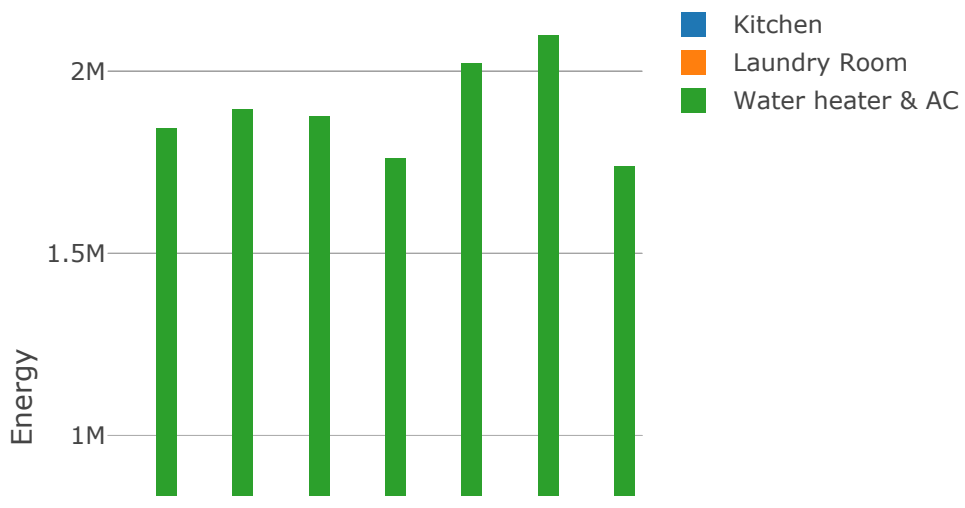
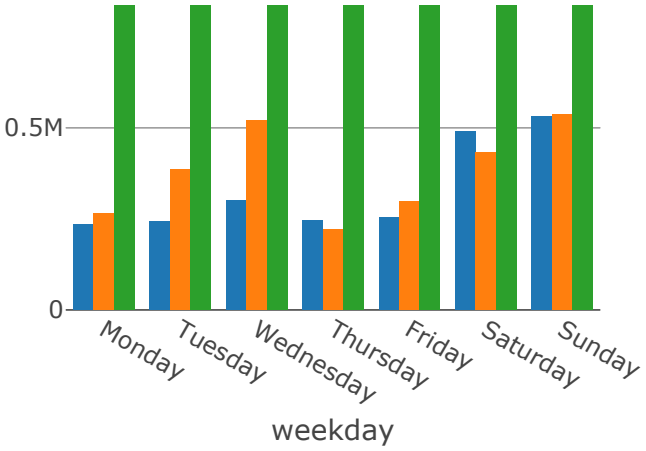
```
# plot bar graph grouped by time of day, stratified with the 3 submeters
plot_ly(weekdaysAllYearsTotals, x = ~weekday, y = ~Kitchen, type = 'bar', name = 'Kitche
n') %>%
  add_trace(y = ~LaundryRoom, name = 'Laundry Room') %>%
  add_trace(y = ~WaterHeaterAC, name = 'Water heater & AC') %>%
  layout(yaxis = list(title = 'Energy'), barmode = 'group')
```




0.5M
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
weekday