## Project Overview

Build a predictive model that identifies the month, hour of day, and appliances (kitchen, laundry, or water heater/ac) that use the most power.

#### Hypothesis

The most power is used by water heater/ac during months of Dec, Jan, Feb, and July between the hours of 6am - 9pm.

#### Data Overview/Cleansing

- Drop irrelevant rows
- Change column names for easier readability
- Change date column to month only
- Change time column to hour of day (24 hour clock)
- Remove '?' and null values
- Use MinMaxScaler for Kitchen, LaundryRoom, and WaterHeat_AC columns due to variance in values
- Removed zero values due to imbalanced data

#### Analysis and Results

- Split data into train and test (80%, 20%)
- Target variable > 'Consumer_active_power?'
- Ran Linear Regression in Scikit Learn and StatsModels
- None of the factors reflected normal distribution
- Very little correlation for any factors
- Scikit Learn provided score of 0.86
- StatsModels provided R-squared of 0.86

In [2]:

```
import pandas as pd
import numpy as np
import csv
import sys
```

In [3]:

```
#df = pd.read_table('household_power_consumption.txt')
with open("household_power_consumption.txt" , "r") as txt_file:
    with open("csv_file.csv", "w") as csv_file:
                in_txt = csv.reader(txt_file, delimiter = ';')
                out_csv = csv.writer(csv_file)
                out_csv.writerows(in_txt)
```

In [4]:

```
df = pd.read_csv('csv_file.csv')
df.head(3)
```

```
/Users/krys/anaconda2/lib/python2.7/site-packages/IPython/core/interactiveshell.py:2717: DtypeWarning: Columns (2,3,4,5,6,7) have mixed types. Specify dtype option on import or set low_memory=False.
  interactivity=interactivity, compiler=compiler, result=result)
```

Out[4]:

| | Date | Time | Global_active_power | Global_reactive_power | Voltage | Global_intensity | Sub_metering_1 | Sub_metering_2 | Sub_metering_3 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 16/12/2006 | 17:24:00 | 4.216 | 0.418 | 234.840 | 18.400 | 0.000 | 1.000 | 17.0 |
| 1 | 16/12/2006 | 17:25:00 | 5.360 | 0.436 | 233.630 | 23.000 | 0.000 | 1.000 | 16.0 |
| 2 | 16/12/2006 | 17:26:00 | 5.374 | 0.498 | 233.290 | 23.000 | 0.000 | 2.000 | 17.0 |

In [5]:

```
df.shape
```

Out[5]:

```
(2075259, 9)
```

In [6]:

```
df.drop(df.columns[[3,4,5]], axis=1, inplace=True)
```

In [7]:

```
df.head(2)
```

Out[7]:

| | Date | Time | Global_active_power | Sub_metering_1 | Sub_metering_2 | Sub_metering_3 |
|---|---|---|---|---|---|---|
| 0 | 16/12/2006 | 17:24:00 | 4.216 | 0.000 | 1.000 | 17.0 |
| 1 | 16/12/2006 | 17:25:00 | 5.360 | 0.000 | 1.000 | 16.0 |

In [8]:

```
df.rename(columns={'Sub_metering_1':'Kitchen',
                   'Sub_metering_2':'LaundryRoom',
                   'Sub_metering_3':'WaterHeat_AC'},
          inplace=True)
```

In [9]:

```
df.head(2)
```

Out[9]:

| | Date | Time | Global_active_power | Kitchen | LaundryRoom | WaterHeat_AC |
|---|---|---|---|---|---|---|
| 0 | 16/12/2006 | 17:24:00 | 4.216 | 0.000 | 1.000 | 17.0 |
| 1 | 16/12/2006 | 17:25:00 | 5.360 | 0.000 | 1.000 | 16.0 |

In [10]:

```
from datetime import datetime
from dateutil.parser import parse
```

In [11]:

```
df['Date'] = pd.to_datetime(df['Date'], format='%d/%m/%Y')
df['Date'] = df['Date'].dt.month
```

In [12]:

```
df['Time'] = pd.to_datetime(df['Time'], format='%H:%M:%S')
df['Time'] = df['Time'].dt.hour
```

In [13]:

```
df.head(2)
```

Out[13]:

| | Date | Time | Global_active_power | Kitchen | LaundryRoom | WaterHeat_AC |
|---|---|---|---|---|---|---|
| 0 | 12 | 17 | 4.216 | 0.000 | 1.000 | 17.0 |
| 1 | 12 | 17 | 5.360 | 0.000 | 1.000 | 16.0 |

In [14]:

```
df['Global_active_power'].value_counts().head()
```

Out[14]:

```
?        25979
0.218     9491
0.216     9319
0.322     9226
0.324     9153
Name: Global_active_power, dtype: int64
```

In [15]:

```
df['Kitchen'].value_counts().head(10)
```

Out[15]:

```
0.000     1840611
1.000       82920
0.0         39564
?           25979
2.000       18537
38.000      15954
37.000      14556
39.000       6452
36.000       5128
1.0          2016
Name: Kitchen, dtype: int64
```

In [16]:

```
df['LaundryRoom'].value_counts().head(10)
```

Out[16]:

```
0.000     1408274
1.000      367317
2.000      153938
0.0         28556
?           25979
1.0         10907
3.000        7096
37.000       6565
4.000        5671
36.000       5498
Name: LaundryRoom, dtype: int64
```

In [17]:

```
df['WaterHeat_AC'].isnull().sum()
```

Out[17]:

```
25979
```

In [18]:

```
df['Global_active_power'].replace('?', np.nan,inplace=True)
```

In [19]:

```
df['Global_active_power'].isnull().value_counts()
```

Out[19]:

```
False    2049280
True       25979
Name: Global_active_power, dtype: int64
```

In [20]:

```
df.dropna(subset=['Global_active_power'], inplace=True)
```

In [21]:

```
df['Global_active_power'].isnull().sum()
```

Out[21]:

```
0
```

In [22]:

```
df['Kitchen'].replace('?', np.nan,inplace=True)
```

In [23]:

```
df['Kitchen'].isnull().value_counts()
```

Out[23]:

```
False    2049280
Name: Kitchen, dtype: int64
```

In [24]:

```
df.dropna(subset=['Kitchen'], inplace=True)
```

In [25]:

```
df['Kitchen'].isnull().sum()
```

Out[25]:

```
0
```

In [26]:

```
#df1 = df1.drop(df1[(df1.LaundryRoom == '?').index])
df['LaundryRoom'].replace('?', np.nan,inplace=True)
```

In [27]:

```
df['LaundryRoom'].isnull().value_counts()
```

Out[27]:

```
False    2049280
Name: LaundryRoom, dtype: int64
```

In [28]:

```
df.dropna(subset=['LaundryRoom'], inplace=True)
```

In [29]:

```
df['LaundryRoom'].isnull().sum()
```

Out[29]:

```
0
```

In [30]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2049280 entries, 0 to 2075258
Data columns (total 6 columns):
Date                   int64
Time                   int64
Global_active_power    object
Kitchen                object
LaundryRoom            object
WaterHeat_AC           float64
dtypes: float64(1), int64(2), object(3)
memory usage: 109.4+ MB
```

#

In [31]:

```
from sklearn.preprocessing import MinMaxScaler
scale = MinMaxScaler()
```

In [32]:

```
df[['Kitchen']] = scale.fit_transform(df[['Kitchen']].as_matrix())
```

```
/Users/krys/anaconda2/lib/python2.7/site-packages/sklearn/utils/validation.py:429: DataConversionWarning: Data with input dtype object was converted to float64 by MinMaxScaler.
  warnings.warn(msg, _DataConversionWarning)
```

In [33]:

```
df['Kitchen'].value_counts()
```

Out[33]:

```
0.000000    1880175
0.011364      84936
0.022727      19017
0.431818      16119
0.420455      14892
0.443182       6503
0.409091       5270
0.397727       1359
0.454545       1159
0.363636        802
0.159091        702
0.170455        635
0.375000        603
0.147727        600
0.136364        597
0.352273        586
0.193182        580
0.181818        579
0.113636        576
0.204545        563
0.306818        546
0.125000        541
0.386364        534
0.102273        522
0.238636        510
0.034091        507
0.227273        505
0.215909        487
0.340909        484
0.318182        480
               ...
0.613636         53
0.818182         46
0.625000         44
0.806818         41
0.875000         34
0.636364         32
0.886364         32
0.795455         29
0.897727         28
0.681818         26
0.909091         19
0.761364         18
0.772727         16
0.715909         16
0.659091         13
0.750000         13
0.670455         13
0.647727         13
0.738636         12
0.727273         12
0.704545         12
0.693182         10
0.784091          9
0.920455          6
0.943182          4
0.988636          3
0.931818          3
1.000000          3
0.954545          2
0.977273          2
Name: Kitchen, dtype: int64
```

In [34]:

```
df[['Global_active_power']] = scale.fit_transform(df[['Global_active_power']].as_matrix())
```

In [35]:

```
df[['LaundryRoom']] = scale.fit_transform(df[['LaundryRoom']].as_matrix())
```

In [36]:

```
df[['WaterHeat_AC']] = scale.fit_transform(df[['WaterHeat_AC']].as_matrix())
```

In [37]:

```
df.head(3)
```

Out[37]:

| | Date | Time | Global_active_power | Kitchen | LaundryRoom | WaterHeat_AC |
|---|---|---|---|---|---|---|
| 0 | 12 | 17 | 0.374796 | 0.0 | 0.0125 | 0.548387 |
| 1 | 12 | 17 | 0.478363 | 0.0 | 0.0125 | 0.516129 |
| 2 | 12 | 17 | 0.479631 | 0.0 | 0.0250 | 0.548387 |

In [38]:

```
df.describe()
```

Out[38]:

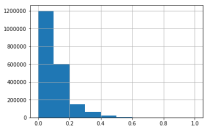
| | Date | Time | Global_active_power | Kitchen | LaundryRoom | WaterHeat_AC |
|---|---|---|---|---|---|---|
| count | 2.049280e+06 | 2.049280e+06 | 2.049280e+06 | 2.049280e+06 | 2.049280e+06 | 2.049280e+06 |
| mean | 6.454433e+00 | 1.150391e+01 | 9.194415e-02 | 1.274913e-02 | 1.623150e-02 | 2.083370e-01 |
| std | 3.423209e+00 | 6.925189e+00 | 9.571738e-02 | 6.992081e-02 | 7.277533e-02 | 2.721663e-01 |
| min | 1.000000e+00 | 0.000000e+00 | 0.000000e+00 | 0.000000e+00 | 0.000000e+00 | 0.000000e+00 |
| 25% | 3.000000e+00 | 5.000000e+00 | 2.100308e-02 | 0.000000e+00 | 0.000000e+00 | 0.000000e+00 |
| 50% | 6.000000e+00 | 1.200000e+01 | 4.761905e-02 | 0.000000e+00 | 0.000000e+00 | 3.225806e-02 |
| 75% | 9.000000e+00 | 1.800000e+01 | 1.314503e-01 | 0.000000e+00 | 1.250000e-02 | 5.483871e-01 |
| max | 1.200000e+01 | 2.300000e+01 | 1.000000e+00 | 1.000000e+00 | 1.000000e+00 | 1.000000e+00 |

In [39]:

```
import matplotlib.pyplot as plt
%matplotlib inline
df.Global_active_power.hist()
```

Out[39]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1140cc850>
```

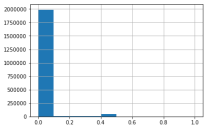



In [40]:

```
df.Kitchen.hist()
```

Out[40]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x11433a610>
```

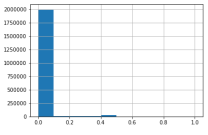



In [41]:

```
df.LaundryRoom.hist()
```

Out[41]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1144e2390>
```



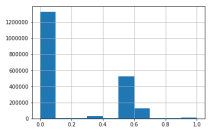

In [42]:

```
df.WaterHeat_AC.hist()
```

```
df.WaterHeat_AC.hist()
```

Out[42]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x114669c90>
```



In [46]:

```
print df.groupby('Date')['Kitchen']
```

```
<pandas.core.groupby.SeriesGroupBy object at 0x114a4c590>
```

In [47]:

```
df = df[df.Kitchen != 0.0]
```

In [48]:

```
df = df[df.LaundryRoom != 0.0]
```

In [49]:

```
df = df[df.WaterHeat_AC != 0.0]
```

In [50]:

```
df['Kitchen'].value_counts().head()
```

Out[50]:

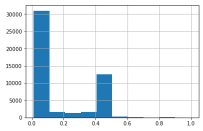
```
0.011364    24533
0.022727     5562
0.420455     4523
0.431818     4188
0.409091     1823
Name: Kitchen, dtype: int64
```

In [51]:

```
df.Kitchen.hist()
```

Out[51]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x114a4cd50>
```

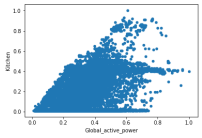


In [52]:

```
df.plot(x='Global_active_power', y='Kitchen', kind='scatter')
```

Out[52]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x114aa0250>
```

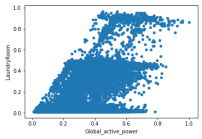



In [53]:

```
df.plot(x='Global_active_power', y='LaundryRoom', kind='scatter')
```

Out[53]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x11706fe90>
```

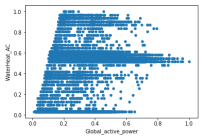



In [54]:

```
df.plot(x='Global_active_power', y='WaterHeat_AC', kind='scatter')
```

Out[54]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1168c9450>
```

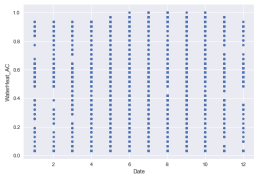



In [92]:

```
df.plot(x='Date', y='WaterHeat_AC', kind='scatter')
```

Out[92]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x11995f190>
```

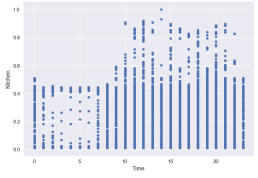



In [94]:

```
df.plot(x='Time', y='Kitchen', kind='scatter')
```

Out[94]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1199eb910>
```

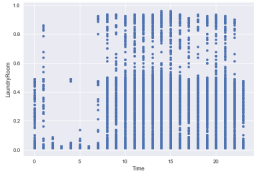



In [95]:

```
df.plot(x='Time', y='LaundryRoom', kind='scatter')
```

Out[95]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x11a05b150>
```




In [55]:

```
df.groupby('Global_active_power')['Kitchen', 'LaundryRoom', 'WaterHeat_AC'].head()
```

Out[55]:

| | Kitchen | LaundryRoom | WaterHeat_AC |
|---|---|---|---|
| **1019** | 0.011364 | 0.0875 | 0.548387 |
| **1020** | 0.022727 | 0.4375 | 0.548387 |
| **1021** | 0.011364 | 0.3250 | 0.548387 |
| **1022** | 0.011364 | 0.4375 | 0.548387 |

| | Kitchen | LaundryRoom | WaterHeat_AC |
|---|---|---|---|
| 1023 | 0.011364 | 0.4625 | 0.548387 |
| 1024 | 0.011364 | 0.4375 | 0.548387 |
| 1025 | 0.022727 | 0.4375 | 0.548387 |
| 1026 | 0.011364 | 0.4375 | 0.548387 |
| 1027 | 0.011364 | 0.4625 | 0.548387 |
| 1028 | 0.011364 | 0.4500 | 0.548387 |
| 1029 | 0.011364 | 0.4625 | 0.548387 |
| 1030 | 0.068182 | 0.4500 | 0.548387 |
| 1031 | 0.420455 | 0.4500 | 0.548387 |
| 1032 | 0.420455 | 0.4375 | 0.516129 |
| 1033 | 0.409091 | 0.4375 | 0.548387 |
| 1034 | 0.420455 | 0.4500 | 0.516129 |
| 1035 | 0.409091 | 0.4375 | 0.548387 |
| 1036 | 0.409091 | 0.4375 | 0.516129 |
| 1037 | 0.420455 | 0.4500 | 0.548387 |
| 1038 | 0.409091 | 0.4375 | 0.516129 |
| 1039 | 0.420455 | 0.4500 | 0.548387 |
| 1040 | 0.409091 | 0.4375 | 0.548387 |
| 1041 | 0.420455 | 0.2875 | 0.548387 |
| 1042 | 0.431818 | 0.3375 | 0.516129 |
| 1043 | 0.409091 | 0.4500 | 0.548387 |
| 1044 | 0.284091 | 0.4375 | 0.548387 |
| 1045 | 0.011364 | 0.3625 | 0.548387 |
| 1046 | 0.022727 | 0.2625 | 0.516129 |
| 1047 | 0.011364 | 0.4500 | 0.548387 |
| 1048 | 0.011364 | 0.4500 | 0.548387 |
| ... | ... | ... | ... |
| 2068777 | 0.011364 | 0.0875 | 0.548387 |
| 2068779 | 0.011364 | 0.1000 | 0.548387 |
| 2068912 | 0.534091 | 0.0125 | 0.548387 |
| 2068926 | 0.227273 | 0.0125 | 0.548387 |
| 2068929 | 0.079545 | 0.0125 | 0.548387 |
| 2068931 | 0.170455 | 0.0125 | 0.548387 |
| 2068938 | 0.159091 | 0.0125 | 0.580645 |
| 2068939 | 0.147727 | 0.0250 | 0.548387 |
| 2068940 | 0.159091 | 0.0125 | 0.548387 |
| 2068953 | 0.011364 | 0.0125 | 0.548387 |
| 2069053 | 0.011364 | 0.0125 | 0.548387 |
| 2072999 | 0.011364 | 0.0125 | 0.580645 |
| 2073002 | 0.011364 | 0.0250 | 0.580645 |
| 2073003 | 0.011364 | 0.0125 | 0.580645 |
| 2073013 | 0.011364 | 0.0250 | 0.580645 |
| 2073022 | 0.420455 | 0.0125 | 0.580645 |
| 2073032 | 0.011364 | 0.0125 | 0.580645 |
| 2073040 | 0.022727 | 0.0250 | 0.580645 |
| 2073047 | 0.011364 | 0.0250 | 0.580645 |
| 2073053 | 0.011364 | 0.0125 | 0.580645 |
| 2074471 | 0.011364 | 0.0250 | 0.580645 |
| 2074472 | 0.022727 | 0.0125 | 0.548387 |
| 2074473 | 0.011364 | 0.0125 | 0.548387 |
| 2074479 | 0.011364 | 0.0125 | 0.548387 |
| 2074482 | 0.022727 | 0.0250 | 0.548387 |
| 2074485 | 0.022727 | 0.0125 | 0.548387 |
| 2074488 | 0.420455 | 0.0250 | 0.548387 |
| 2074494 | 0.431818 | 0.0250 | 0.548387 |
| 2074503 | 0.011364 | 0.0125 | 0.580645 |
| 2074504 | 0.011364 | 0.0125 | 0.580645 |

16514 rows × 3 columns

In [56]:

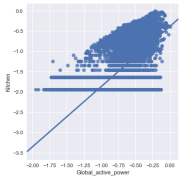
```
log_columns = ['Global_active_power', 'Kitchen']
log_df = df.copy()
log_df[log_columns] = log_df[log_columns].apply(np.log10)
```

In [57]:

```
import seaborn as sns
sns.lmplot('Global_active_power', 'Kitchen', log_df)
```

Out[57]:

```
<seaborn.axisgrid.FacetGrid at 0x116a1a450>
```




In [58]:

```
df.corr()
```

Out[58]:

| | Date | Time | Global_active_power | Kitchen | LaundryRoom | WaterHeat_AC |
|---|---|---|---|---|---|---|
| **Date** | 1.000000 | -0.029764 | -0.059210 | -0.012303 | -0.030546 | -0.085688 |
| **Time** | -0.029764 | 1.000000 | 0.124053 | -0.000787 | -0.029223 | -0.122444 |
| **Global_active_power** | -0.059210 | 0.124053 | 1.000000 | 0.645848 | 0.586256 | 0.305524 |
| **Kitchen** | -0.012303 | -0.000787 | 0.645848 | 1.000000 | 0.006576 | 0.009362 |
| **LaundryRoom** | -0.030546 | -0.029223 | 0.586256 | 0.006576 | 1.000000 | 0.056804 |
| **WaterHeat_AC** | -0.085688 | -0.122444 | 0.305524 | 0.009362 | 0.056804 | 1.000000 |

In [59]:

```
#from sklearn.model_selection import StratifiedKFold
#X_train, X_test, y_train, y_test = cross_validation.train_test_split(x,y,
#                                                                     test_size=0.20,
#                                                                     random_state=0)
```

In [60]:

```
df = df[['Date', 'Time', 'Kitchen', 'LaundryRoom', 'WaterHeat_AC', 'Global_active_power']]
```

In [61]:

```
df.head()
```

Out[61]:

| | Date | Time | Kitchen | LaundryRoom | WaterHeat_AC | Global_active_power |
|---|---|---|---|---|---|---|
| **1019** | 12 | 10 | 0.011364 | 0.0875 | 0.548387 | 0.196089 |
| **1020** | 12 | 10 | 0.022727 | 0.4375 | 0.548387 | 0.329350 |
| **1021** | 12 | 10 | 0.011364 | 0.3250 | 0.548387 | 0.283904 |
| **1022** | 12 | 10 | 0.011364 | 0.4375 | 0.548387 | 0.327539 |
| **1023** | 12 | 10 | 0.011364 | 0.3375 | 0.548387 | 0.283179 |

In [62]:

```
from sklearn.cross_validation import train_test_split
```

```
/Users/krys/anaconda2/lib/python2.7/site-packages/sklearn/cross_validation.py:44: DeprecationWarning: This module was deprecated in version 0.18 in favor of the model_selection module into which all the refactored classes and functions are moved. Also note that the interface of the new CV iterators are different from that o
f this module. This module will be removed in 0.20.
  "This module will be removed in 0.20.", DeprecationWarning)
```

In [63]:

```
train, test = train_test_split(df, train_size=.80, test_size=.20)
```

In [64]:

```
from sklearn import linear_model
from sklearn.linear_model import LinearRegression
lin_model = linear_model.LinearRegression()
```

In [80]:

```
feature_cols = ['Date', 'Time', 'Kitchen', 'LaundryRoom', 'WaterHeat_AC']
X = train[feature_cols]
y = train.Global_active_power
```

In [81]:

```
lin_model.fit(X,y)
```

Out[81]:

```
LinearRegression(copy_X=True, fit_intercept=True, n_jobs=1, normalize=False)
```

In [86]:

```
print lin_model.intercept_
print lin_model.coef_
```

```
-0.0232587114105
[ -1.17121708e-04   4.97507939e-03   4.93865726e-01   4.63246609e-01
   1.97212089e-01]
```

In [84]:

```
pd.DataFrame(zip(train.columns, lin_model.coef_), columns = ['factors', 'est_Coef'])
```

Out[84]:

| | factors | est_Coef |
|---|---|---|
| 0 | Date | -0.000117 |
| 1 | Time | 0.004975 |
| 2 | Kitchen | 0.493866 |
| 3 | LaundryRoom | 0.463247 |
| 4 | WaterHeat_AC | 0.197212 |

In [88]:

In [88]:
```
lin_model.score(X,y)
```

Out[88]:
```
0.8572453612731407
```

In [89]:
```
test_feature_cols = ['Date', 'Time', 'Kitchen', 'LaundryRoom', 'WaterHeat_AC']
test_X = test[feature_cols]
test_y = test.Global_active_power
```

In [91]:
```
lin_model.score(test_X,test_y)
```

Out[91]:
```
0.8600240604229396
```

In [70]:
```
# STATS MODELS
```

In [71]:
```
import statsmodels.formula.api as smf
```

In [72]:
```
lm = smf.ols(formula='Global_active_power ~ Kitchen + LaundryRoom + WaterHeat_AC',
             data=df).fit()
```

In [73]:
```
lm.params
```

Out[73]:
```
Intercept       0.059622
Kitchen         0.493899
LaundryRoom     0.459931
WaterHeat_AC    0.183372
dtype: float64
```

In [75]:
```
lm.summary()
```

Out[75]:

OLS Regression Results

| | | | |
|---|---|---|---|
| **Dep. Variable:** | Global_active_power | **R-squared:** | 0.827 |
| **Model:** | OLS | **Adj. R-squared:** | 0.827 |
| **Method:** | Least Squares | **F-statistic:** | 7.764e+04 |
| **Date:** | Mon, 20 Feb 2017 | **Prob (F-statistic):** | 0.00 |
| **Time:** | 18:02:46 | **Log-Likelihood:** | 66873. |
| **No. Observations:** | 48693 | **AIC:** | -1.337e+05 |
| **Df Residuals:** | 48689 | **BIC:** | -1.337e+05 |
| **Df Model:** | 3 | | |
| **Covariance Type:** | nonrobust | | |

| | coef | std err | t | P>\|t\| | [95.0% Conf. Int.] |
|---|---|---|---|---|---|
| **Intercept** | 0.0596 | 0.001 | 82.304 | 0.000 | 0.058 0.061 |
| **Kitchen** | 0.4939 | 0.001 | 339.401 | 0.000 | 0.491 0.497 |
| **LaundryRoom** | 0.4599 | 0.002 | 300.323 | 0.000 | 0.457 0.463 |
| **WaterHeat_AC** | 0.1834 | 0.001 | 141.631 | 0.000 | 0.181 0.186 |

| | | | |
|---|---|---|---|
| **Omnibus:** | 10314.988 | **Durbin-Watson:** | 0.184 |
| **Prob(Omnibus):** | 0.000 | **Jarque-Bera (JB):** | 19654.854 |
| **Skew:** | 1.310 | **Prob(JB):** | 0.00 |
| **Kurtosis:** | 4.682 | **Cond. No.** | 6.26 |

In [76]:
```
lm = smf.ols(formula='Global_active_power ~ Kitchen + LaundryRoom + WaterHeat_AC + Date + Time',
             data=df).fit()
```

In [77]:
```
lm.summary()
```

Out[77]:

OLS Regression Results

| | | | |
|---|---|---|---|
| **Dep. Variable:** | Global_active_power | **R-squared:** | 0.858 |
| **Model:** | OLS | **Adj. R-squared:** | 0.858 |
| **Method:** | Least Squares | **F-statistic:** | 5.875e+04 |
| **Date:** | Mon, 20 Feb 2017 | **Prob (F-statistic):** | 0.00 |
| **Time:** | 18:09:10 | **Log-Likelihood:** | 71635. |
| **No. Observations:** | 48693 | **AIC:** | -1.433e+05 |
| **Df Residuals:** | 48687 | **BIC:** | -1.432e+05 |
| **Df Model:** | 5 | | |
| **Covariance Type:** | nonrobust | | |

| | coef | std err | t | P>\|t\| | [95.0% Conf. Int.] |
|---|---|---|---|---|---|
| **Intercept** | -0.0225 | 0.001 | -18.926 | 0.000 | -0.025 -0.020 |
| **Kitchen** | 0.4938 | 0.001 | 374.162 | 0.000 | 0.491 0.496 |
| **LaundryRoom** | 0.4630 | 0.001 | 333.212 | 0.000 | 0.460 0.466 |
| **WaterHeat_AC** | 0.1978 | 0.001 | 166.581 | 0.000 | 0.195 0.200 |
| **Date** | -0.0002 | 7.49e-05 | -2.299 | 0.022 | -0.000 -2.54e-05 |
| **Time** | 0.0049 | 4.82e-05 | 102.350 | 0.000 | 0.005 0.005 |

| | | | |
|---|---|---|---|
| **Omnibus:** | 12342.380 | **Durbin-Watson:** | 0.216 |
| **Prob(Omnibus):** | 0.000 | **Jarque-Bera (JB):** | 33023.272 |
| **Skew:** | 1.363 | **Prob(JB):** | 0.00 |
| **Kurtosis:** | 5.974 | **Cond. No.** | 105. |

In [ ]:
```

```

In [ ]:
```

```

In [ ]:
```

```