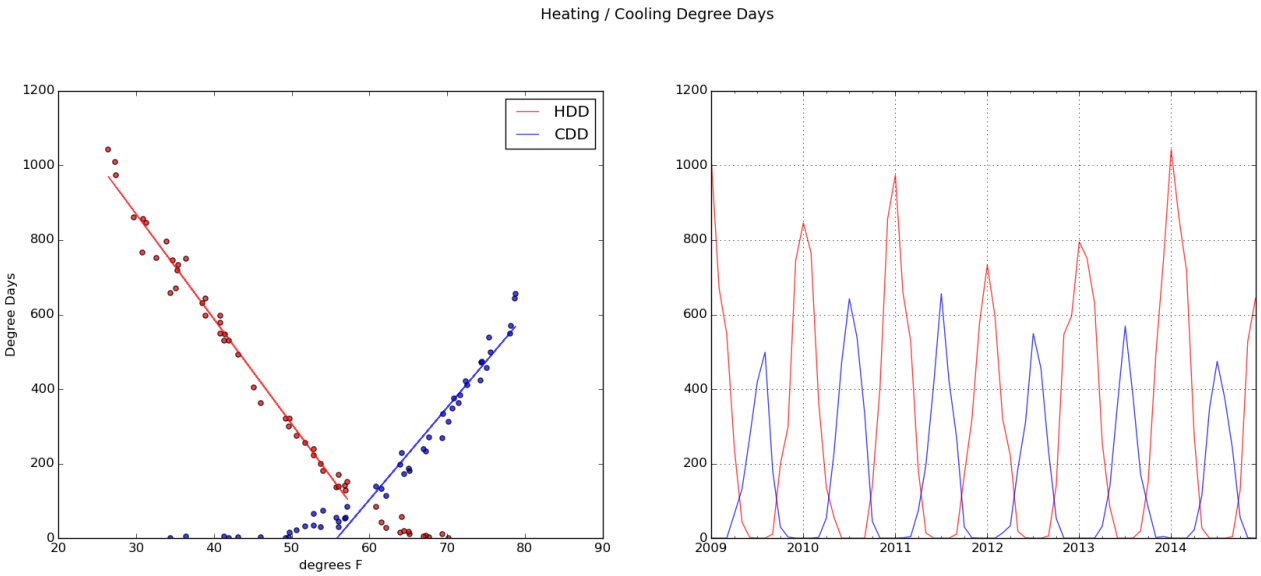
Temperature & Heating Degree Days

By convention (according to the inter-webs), a base temperature of 60 – 65 ºF is used to determine heating and cooling degree days. Slightly different values seem better suited to Princeton – the better fitting lines cross zero at 60 ºF (heating) and at 55 ºF (cooling). When the number of degree days is small the data gets a bit noisy – probably since average monthly temperatures masks higher daily variation in mild weather.

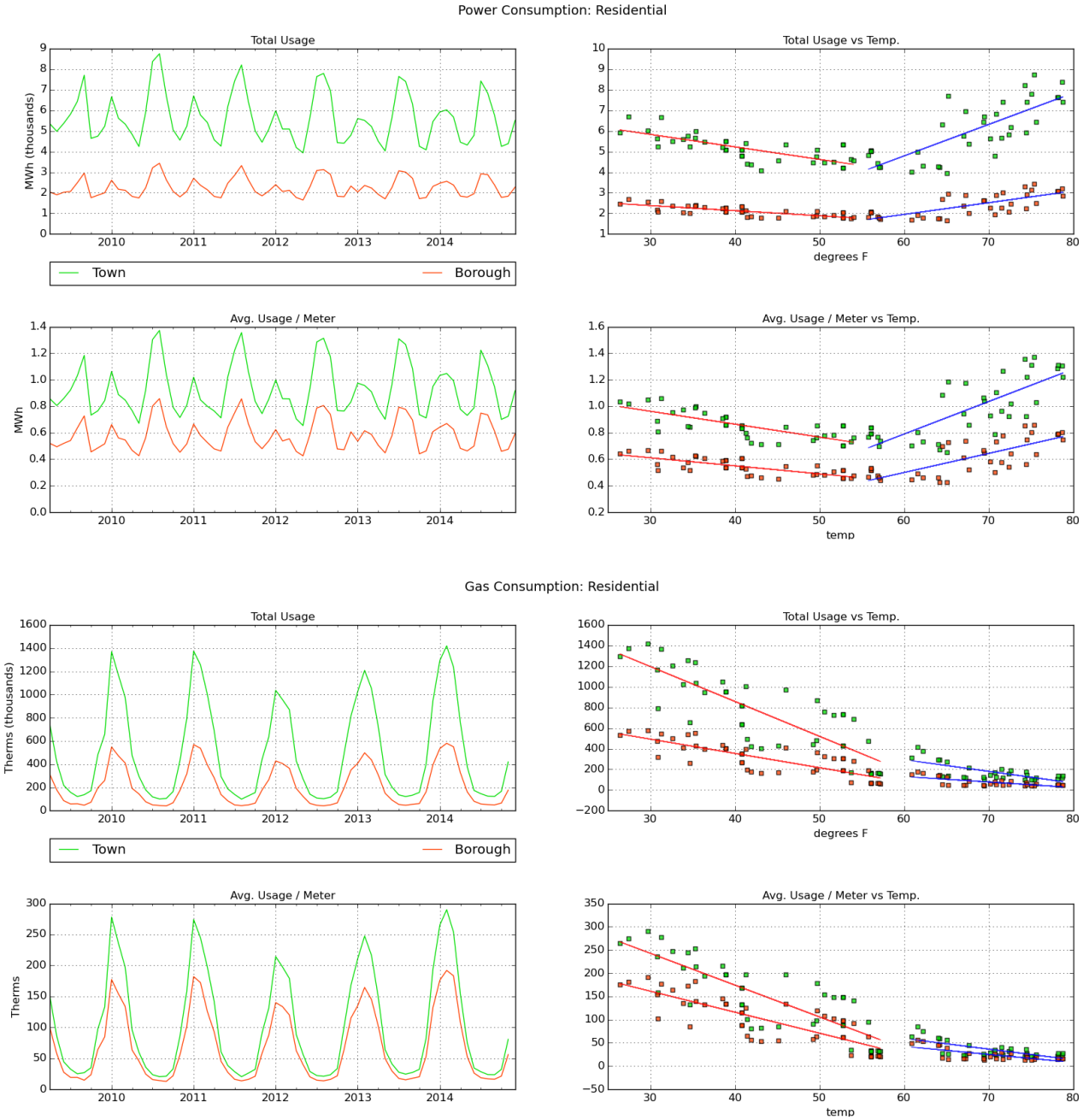


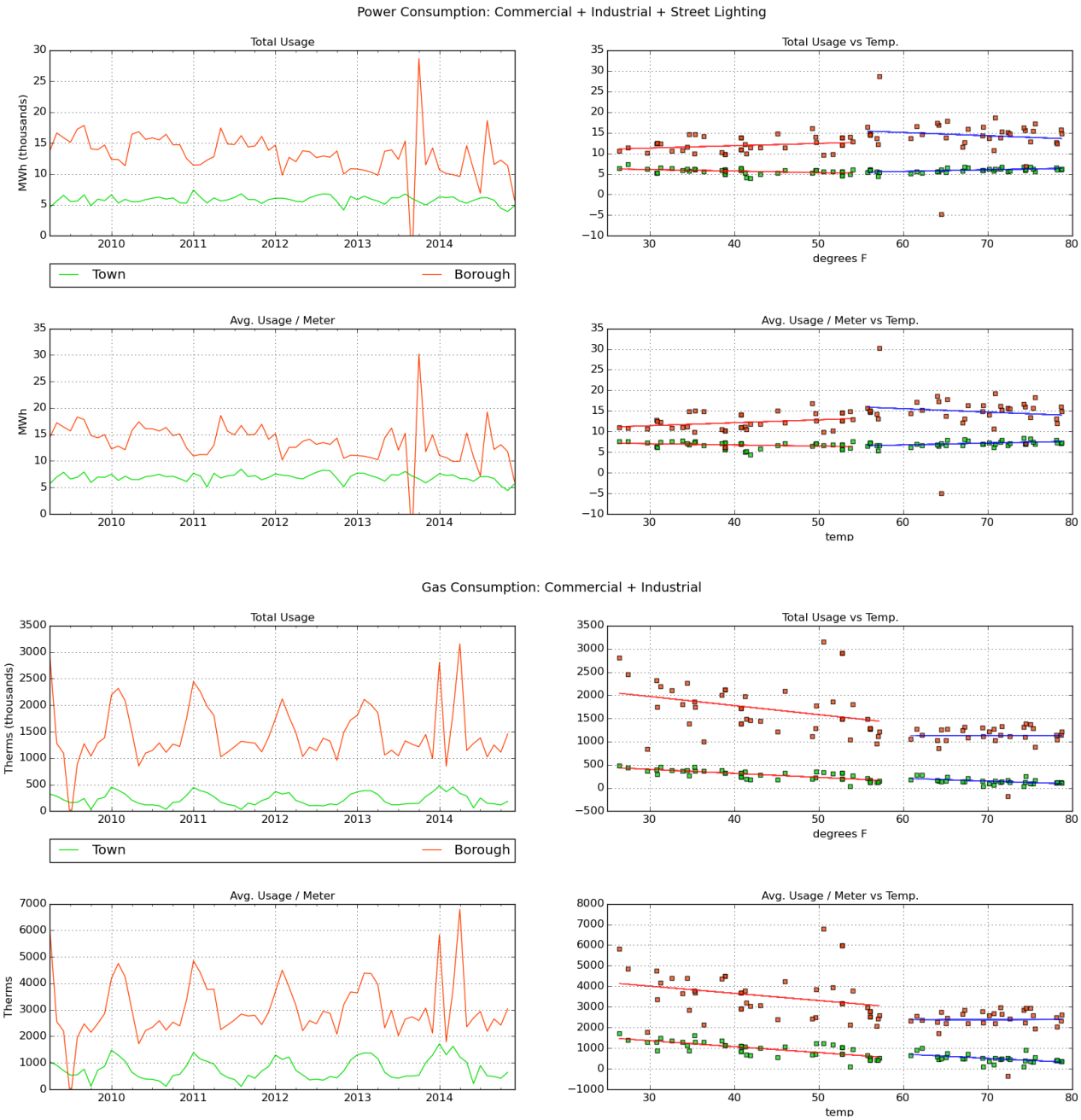
Sources:
Heating / cooling degree days: http://weatherdatadepot.com/
Historical monthly temperature: http://climate.rutgers.edu/stateclim_v1/data/njhisttemp.html

Town & Borough

Comparative plots vs time and temperature highlight the lower residential and higher commercial usage in the boro. Comparing residential meter counts to 2010 census data:

	Housing Units (2010 Census)	Electricity Meters (12/2010 PSE&G)	Gas Meters (12/2010 PSE&G)	Population	Population Density
Boro	3,488	3,871	3,047	12,307	1,825
Town	6,814	5,955	4,846	16,265	423





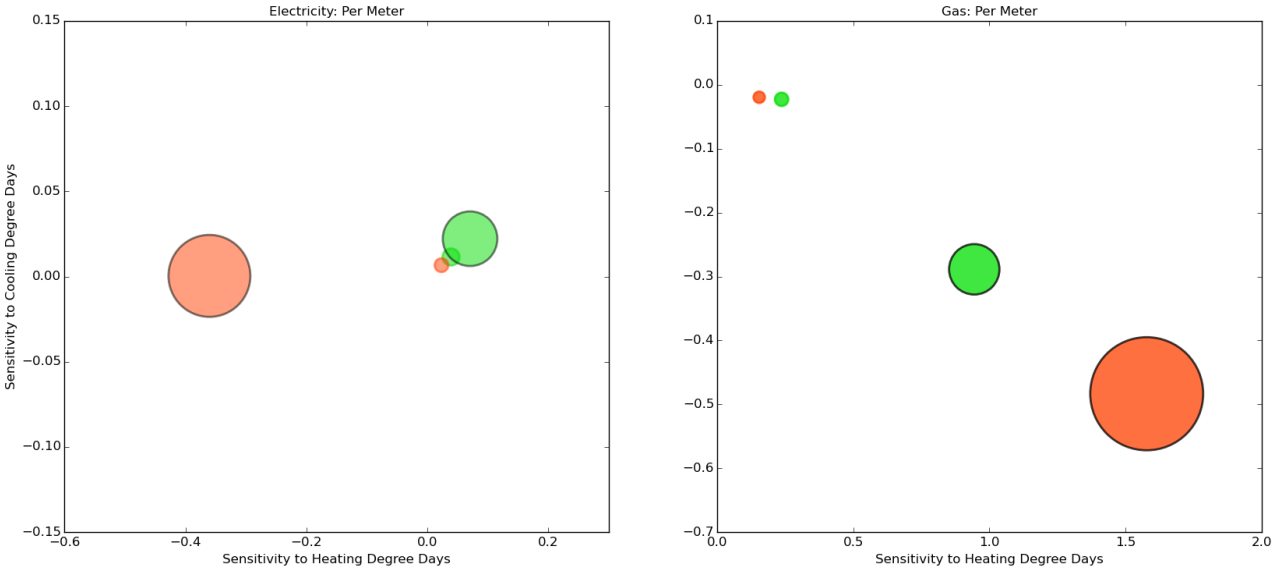
Energy use responds to temperature roughly linearly, which suggests a linear model of he form:

usage = base load + h * heating degree days + c * cooling degree days

Which can be visualized in a “you are here” plot. High values on either axes are “bad” in that they mean higher consumption for each degree day increase. The are of a bubble indicates base load.

The larger bubbles are the Commercial + Industrial category and are distinguished by the dark borders. Finally, regression outputs are listed – the fits are not great, but will do for visualization.

"You Are Here"


Electricity: Per Meter
Sensitivity to Cooling Degree Days
Sensitivity to Heating Degree Days
0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
−0.6
−0.4
−0.2
0.0
0.2
Gas: Per Meter
Sensitivity to Heating Degree Days
0.1
0.0
−0.1
−0.2
−0.3
−0.4
−0.5
−0.6
−0.7
0.0
0.5
1.0
1.5
2.0

Per Meter Regressions

Electricity: TWP Residential

```
----------------------Estimated Coefficients-----------------------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD     0.0004     0.0001       5.96     0.0000     0.0003     0.0005
           CDD     0.0011     0.0001      10.67     0.0000     0.0009     0.0014
     intercept     0.6285     0.0377      16.69     0.0000     0.5547     0.7024

R-squared:         0.6788              Adj R-squared:     0.6675
```

Electricity: BORO Residential

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD     0.0002     0.0000       5.57     0.0000     0.0002     0.0003
           CDD     0.0007     0.0001       9.67     0.0000     0.0005     0.0008
     intercept     0.4103     0.0241      17.00     0.0000     0.3630     0.4576

R-squared:         0.6320              Adj R-squared:     0.6191
```

Electricity: TWP Commercial + Industrial + Street Lighting

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD     0.0007     0.0004       1.72     0.0908    -0.0001     0.0015
           CDD     0.0022     0.0007       3.31     0.0016     0.0009     0.0035
     intercept     6.3650     0.2350      27.08     0.0000     5.9044     6.8257

R-squared:         0.1731              Adj R-squared:     0.1441
```

Electricity: BORO Commercial + Industrial + Street Lighting

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD    -0.0036     0.0023      -1.54     0.1292    -0.0082     0.0010
           CDD     0.0000     0.0038       0.01     0.9924    -0.0074     0.0075
     intercept    14.3125     1.3358      10.71     0.0000    11.6944    16.9306

R-squared:         0.0812              Adj R-squared:     0.0489
```

Gas: TWP Residential

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD     0.2360     0.0208      11.34     0.0000     0.1952     0.2768
           CDD    -0.0227     0.0337      -0.67     0.5028    -0.0888     0.0433
     intercept    38.6897    11.8354       3.27     0.0018    15.4924    61.8871

R-squared:         0.8389              Adj R-squared:     0.8332
```

Gas: PRINCETON BORO Residential

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD     0.1537     0.0146      10.52     0.0000     0.1251     0.1823
           CDD    -0.0195     0.0237      -0.83     0.4129    -0.0659     0.0268
     intercept    28.0604     8.3046       3.38     0.0013    11.7834    44.3374

R-squared:         0.8217              Adj R-squared:     0.8154
```

Gas: TWP Commercial + Industrial

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD     0.9442     0.1253       7.54     0.0000     0.6987     1.1897
           CDD    -0.2888     0.2028      -1.42     0.1601    -0.6863     0.1088
     intercept   542.0172    71.2184       7.61     0.0000   402.4291   681.6053

R-squared:         0.7343              Adj R-squared:     0.7249
```

Gas: BORO Commercial + Industrial

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD     1.5780     0.4725       3.34     0.0015     0.6518     2.5042
           CDD    -0.4835     0.7652      -0.63     0.5301    -1.9832     1.0163
     intercept  2723.7919   268.6715      10.14     0.0000  2197.1958  3250.3881

R-squared:         0.3518              Adj R-squared:     0.3287
```

Regressions of Aggregate Consumption

Electricity: TWP Residential

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD     2.4855     0.3938       6.31     0.0000     1.7136     3.2574
           CDD     7.2339     0.6402      11.30     0.0000     5.9791     8.4886
     intercept  3714.8522   224.7784      16.53     0.0000  3274.2866  4155.4178

R-squared:         0.7033              Adj R-squared:     0.6929
```

Electricity: BORO Residential

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD     0.9278     0.1657       5.60     0.0000     0.6030     1.2525
           CDD     2.6527     0.2694       9.85     0.0000     2.1248     3.1807
     intercept  1585.0312    94.5784      16.76     0.0000  1399.6575  1770.4049

R-squared:         0.6414              Adj R-squared:     0.6289
```

Electricity: TWP Commercial + Industrial + Street Lighting

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD     0.8804     0.3218       2.74     0.0083     0.2498     1.5111
           CDD     2.1203     0.5230       4.05     0.0002     1.0952     3.1453
     intercept  5221.3054   183.6393      28.43     0.0000  4861.3725  5581.2384

R-squared:         0.2247              Adj R-squared:     0.1975
```

Electricity: BORO Commercial + Industrial + Street Lighting

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD    -3.0804     2.2450      -1.37     0.1754    -7.4806     1.3198
           CDD     0.4627     3.6491       0.13     0.8996    -6.6896     7.6150
     intercept 13731.5694  1281.3064      10.72     0.0000 11220.2088 16242.9300

R-squared:         0.0736              Adj R-squared:     0.0411
```

Gas: TWP Residential

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD  1161.7652   102.3517      11.35     0.0000   961.1558  1362.3746
           CDD  -108.2812   165.7356      -0.65     0.5162  -433.1229   216.5606
    intercept 190223.5438 58193.8067       3.27     0.0018 76163.6828 304283.4049

R-squared:         0.8389              Adj R-squared:     0.8331
```

Gas: BORO Residential

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD   469.8198    44.3576      10.59     0.0000   382.8789   556.7607
           CDD   -57.7859    71.8271      -0.80     0.4245  -198.5671    82.9952
     intercept 85728.5335 25220.2503       3.40     0.0013 36296.8429 135160.2241

R-squared:         0.8231              Adj R-squared:     0.8168
```

Gas: TWP Commercial + Industrial

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD   287.2078    34.2137       8.39     0.0000   220.1490   354.2666
           CDD   -75.1067    55.4013      -1.36     0.1806  -183.6933    33.4799
     intercept 152260.6993 19452.7602       7.83     0.0000 114133.2893 190388.1093

R-squared:         0.7674              Adj R-squared:     0.7591
```

Gas: BORO Commercial + Industrial

```
----------------------Summary of Estimated Coefficients-----------------------
      Variable       Coef    Std Err     t-stat    p-value    CI 2.5%   CI 97.5%
--------------------------------------------------------------------------------
           HDD   877.4050   224.9157       3.90     0.0003   436.5703  1318.2397
           CDD  -151.3383   364.2003      -0.42     0.6793  -865.1708   562.4942
     intercept 1252617.1417 127879.6029       9.80     0.0000 1001973.1200 1503261.1634

R-squared:         0.3974              Adj R-squared:     0.3758
```