

PREDICTING DAILY ENERGY USAGE FOR HOMES IN LONDON

Prepared By:
Rami Subramaniam



1. BUSINESS UNDERSTANDING

- See which factors affect energy usage for the average home on London England

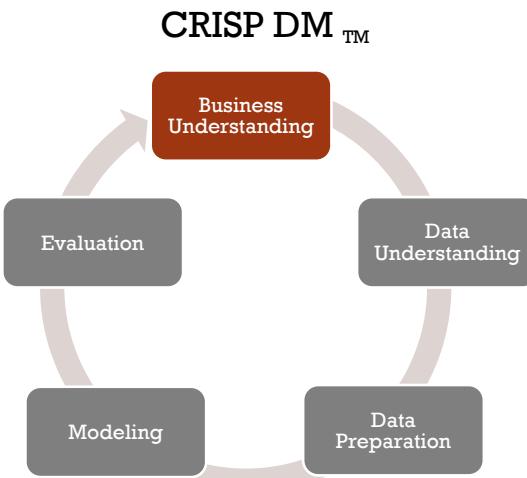
- Weather: Temperature, Humidity, Wind, Dewpoint
- Household size: # of Rooms and People
- Type of neighborhood: Affluent, Comfortable, and Adversity
- When: Day of Week

- **Purpose:**

- Guide power producers
- Planning of future energy policy
- Tips for home-owners

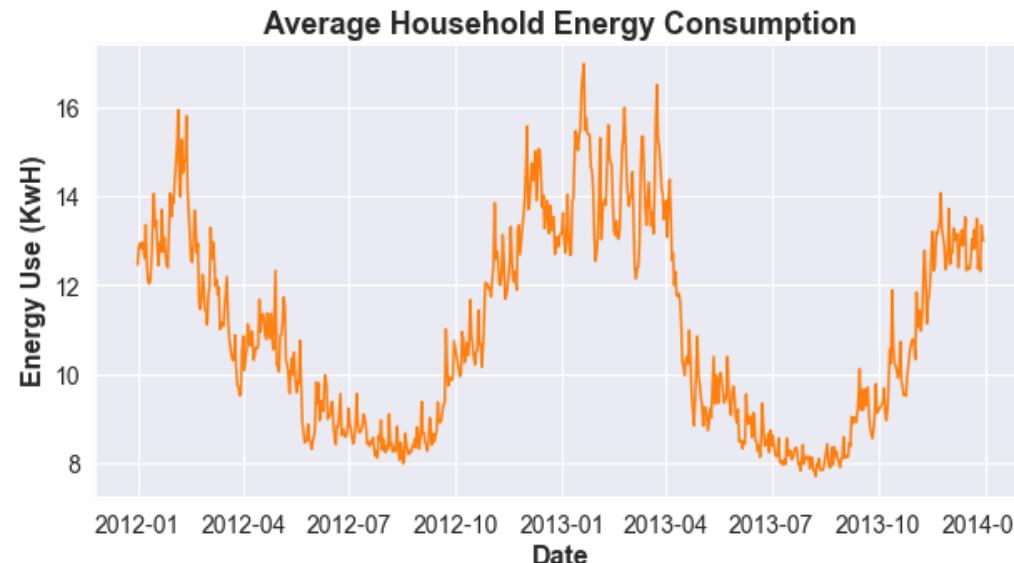
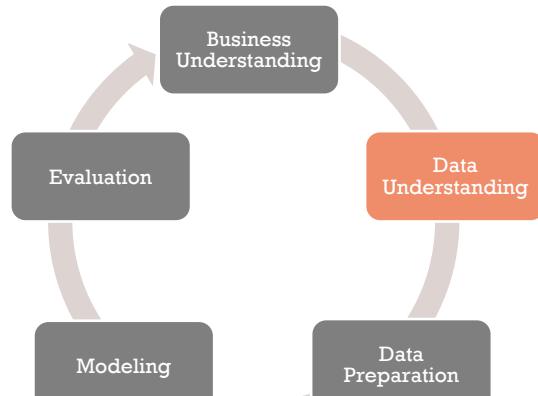
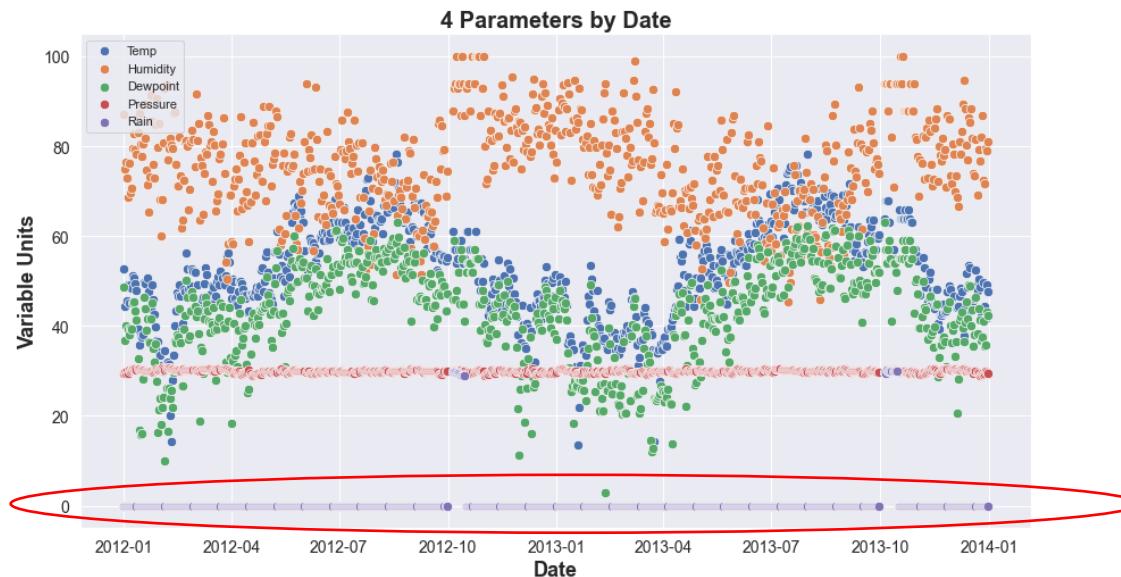
“To better follow the energy consumption, the government wants energy suppliers to install smart meters in every home in England, Wales and Scotland.

This roll out is lead by the European Union who asked all member governments to look at smart meters as part of measures to upgrade the energy supply and tackle climate change. After an initial study, the British government decided to adopt smart meters as part of their plan to update our ageing energy system.”



2: DATA UNDERSTANDING

- Weather Underground:
 - Scrapped historical data from 01/2012 - 12/2013
 - All Zeroes for Rain!
- Energy Usage (Kaggle):
 - Energy usage from 5000+ smart meters in London Area.
 - Household info



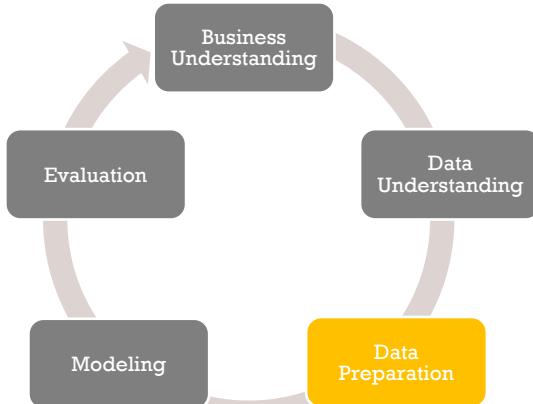
3. DATA PREPARATION

Weather Parameters

Parameter
Temperature(F)
Dew Point(F)
Pressure(Hg)
Humidity(%)
Wind Speed (mph)
Daylight (Min)

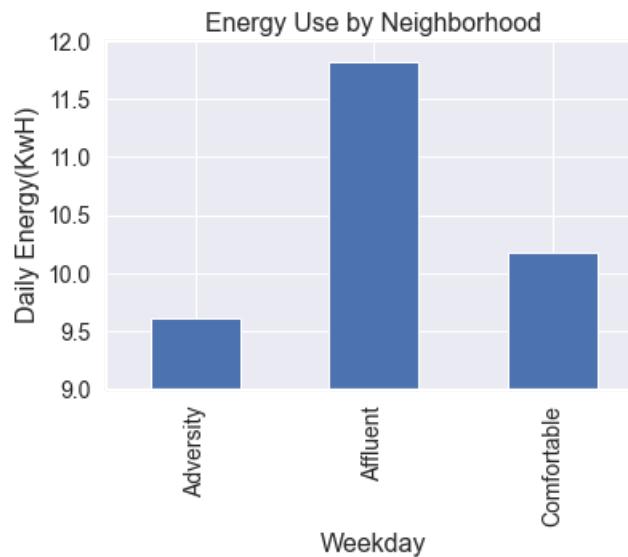
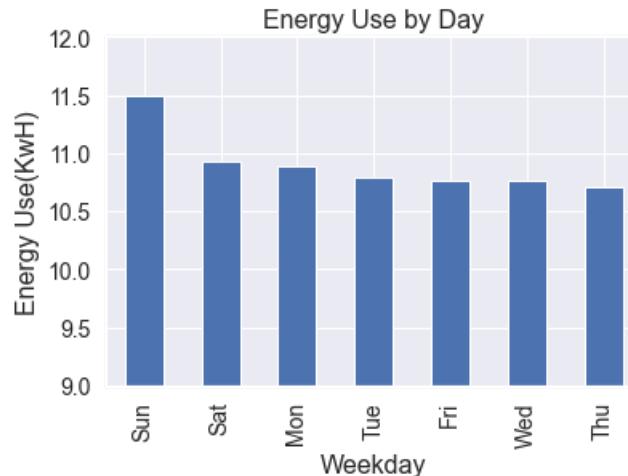
Calculated Parameters

Parameter
Expected # of Bedrooms
Expected # of People
Neighborhood by Wealth
Day of Week

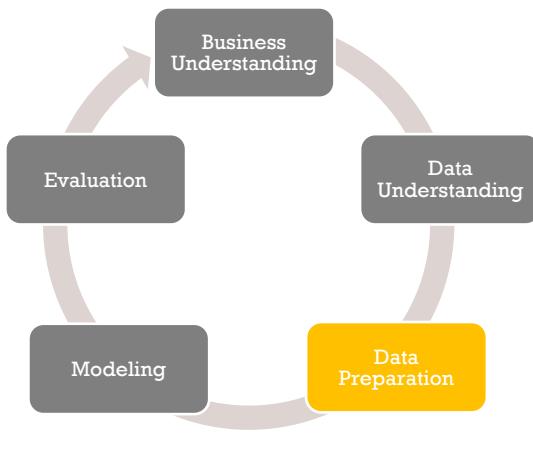
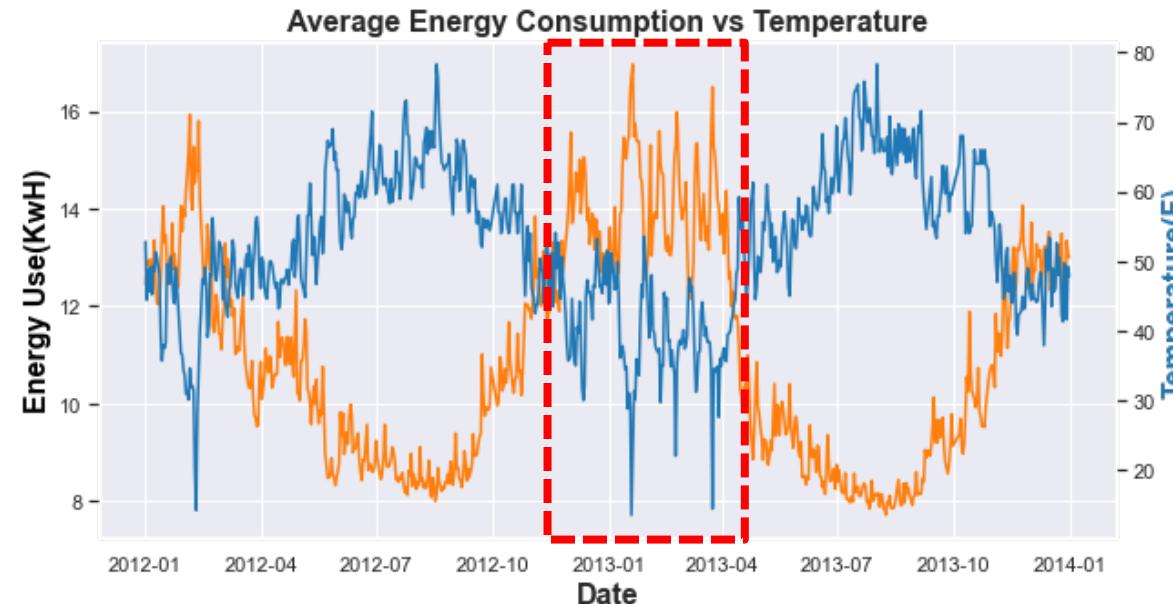


3: DATA PREPARATION

Categorical Trends



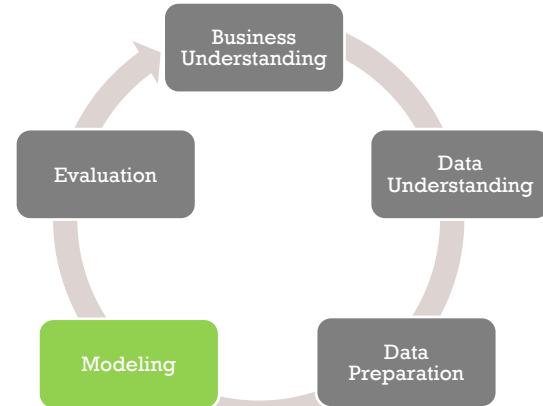
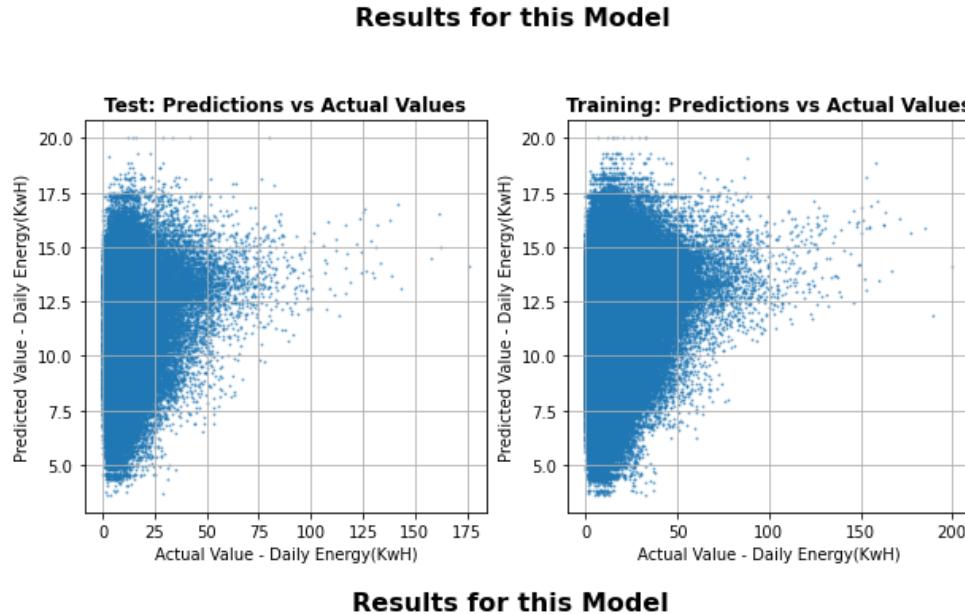
Energy vs. Temperature



4. DATA MODELING

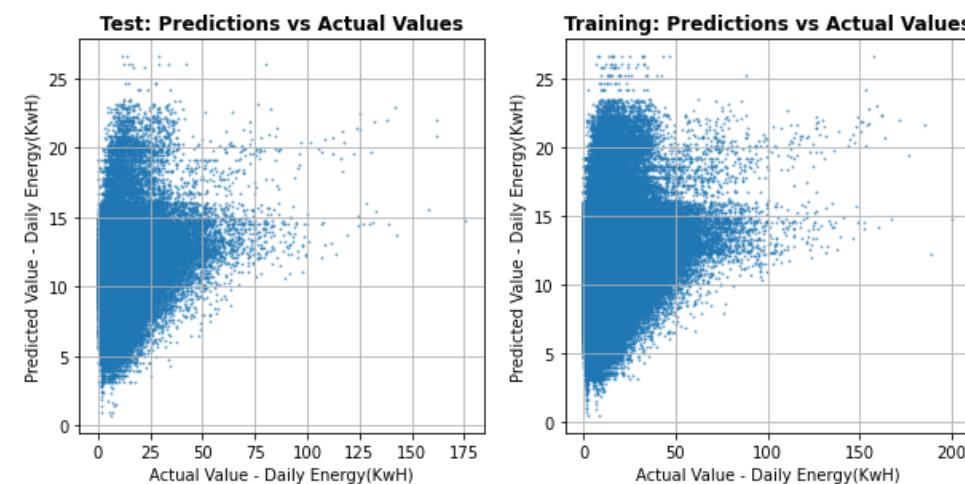
1st Pass:

- Features – Only Weather-Related
 - $R^2 = .059$
 - Mean Average Error = 6.29 kWh



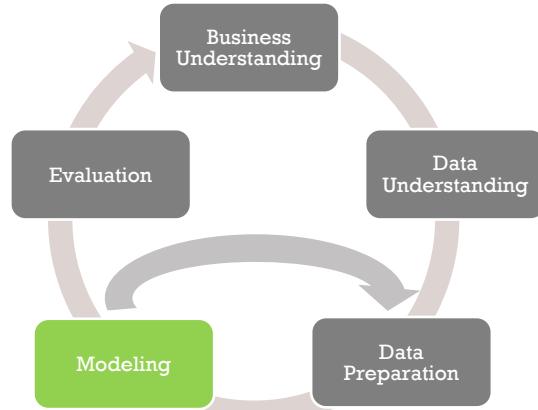
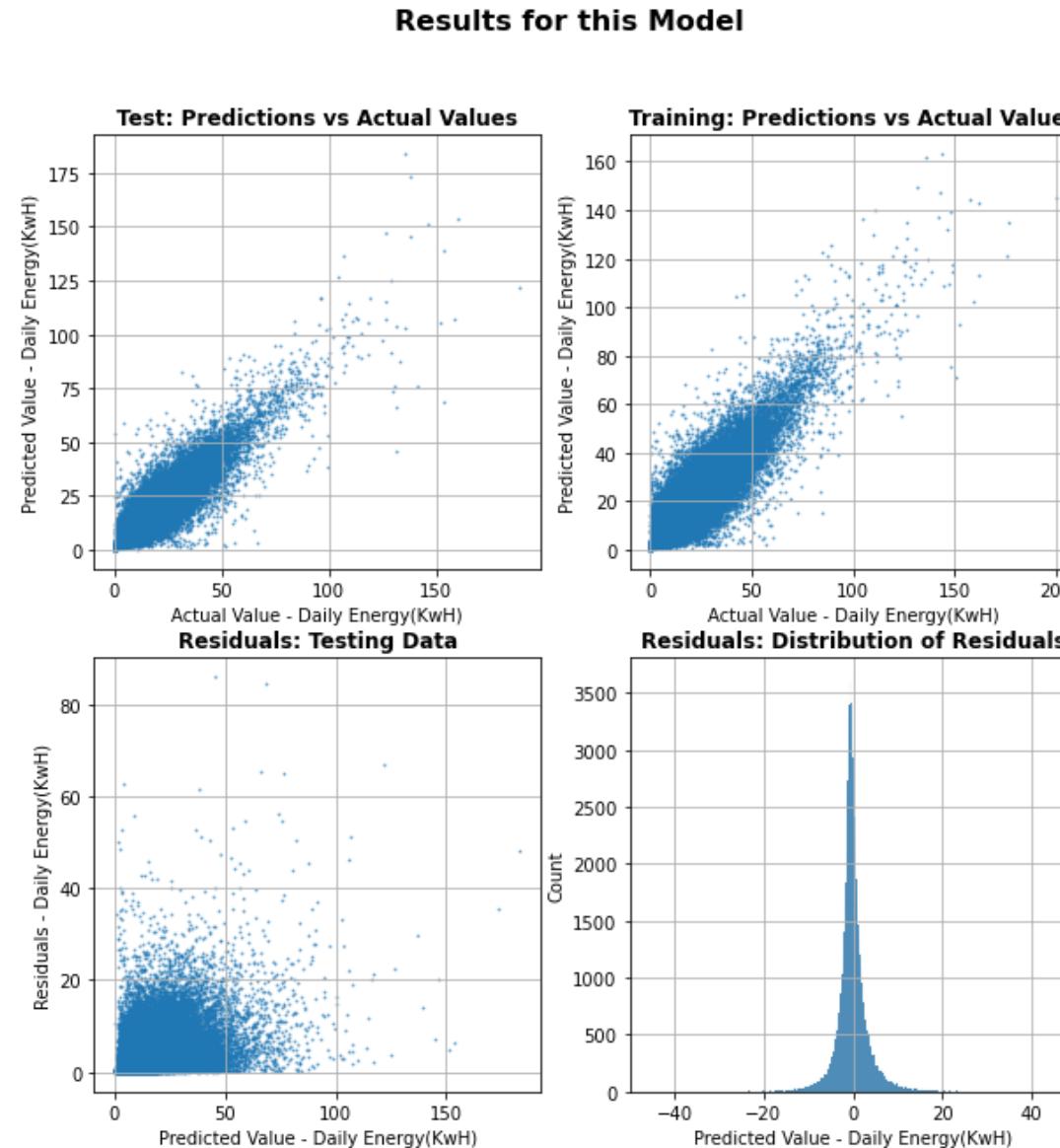
2nd Pass:

- Features – With Categorical Variables
 - $R^2 = .075$
 - Mean Average Error = 6.25 kWh



4. DATA MODELING

- Feature Engineering:
 - Included column which tracks energy for a given home on the day before
 - Convert to TimeSeries
- $R^2 = .839$
- Mean Avg Error = 2.36KwH



5. MODEL EVALUATION

- Critical Features:**
 - Temperature
 - # of bedrooms
 - Neighborhood Affluence
 - Sunday
- Features to Drop:**
 - # of People
 - Pressure(Hg)

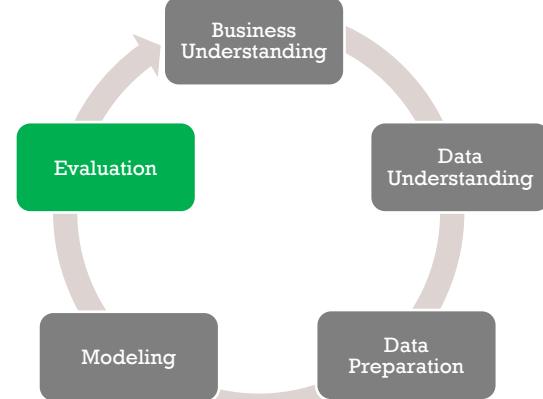
Lasso Modeling Results	
Parameter	Coefficient
Exp_Value_People	0.0000
Exp_Value_Beds	0.0836
Temperature(F)	-0.1974
Humidity(%)	0.0719
Wind_Speed(mph)	0.0248
Pressure(Hg)	0.0000
Adversity	0.0283
Affluent	0.0817
Mon	-0.1591
Sat	0.0601
Sun	0.1901
Thu	0.0000
Tue	-0.0262
Fri	0.0181
shifted	8.8792

```

Dep. Variable: daily_energy(KwH) R-squared:  0.839
Model: OLS Adj. R-squared:  0.839
Method: Least Squares F-statistic:  1.914e+05
Date: Thu, 08 Oct 2020 Prob (F-statistic):  0.00
Time: 14:20:55 Log-Likelihood: -1.5326e+06
No. Observations: 550445 AIC: 3.065e+06
Df Residuals: 550429 BIC: 3.065e+06
Df Model: 15
Covariance Type: nonrobust

```

	coef	std err	t	P> t	[0.025	0.975]
const	0.5395	0.573	0.942	0.346	-0.583	1.662
Exp_Value_People	-0.0571	0.028	-2.018	0.044	-0.113	-0.002
Exp_Value_Beds	0.2207	0.017	13.079	0.000	0.188	0.254
Temperature(F)	-0.0184	0.001	-34.715	0.000	-0.019	-0.017
Humidity(%)	0.0078	0.001	14.585	0.000	0.007	0.009
Wind_Speed(mph)	0.0075	0.001	5.615	0.000	0.005	0.010
Pressure(Hg)	0.0009	0.019	0.051	0.960	-0.035	0.037
Adversity	0.2225	0.025	8.798	0.000	0.173	0.272
Affluent	0.2535	0.017	14.913	0.000	0.220	0.287
Mon	-0.4866	0.020	-24.509	0.000	-0.525	-0.448
Sat	0.1982	0.020	9.995	0.000	0.159	0.237
Sun	0.5650	0.020	28.486	0.000	0.526	0.604
Thu	-0.0168	0.020	-0.844	0.398	-0.056	0.022
Tue	-0.0762	0.020	-3.823	0.000	-0.115	-0.037
Fri	0.0623	0.020	3.134	0.002	0.023	0.101
shifted	0.9089	0.001	1628.361	0.000	0.908	0.910



CLOSING REMARKS

- **Temperature** is the low-hanging fruit when it comes to reducing home energy consumption
 - Do solar panels make sense?
 - Improve Home Insulation
 - Efficient Heating
 - More Scotch!
- Future Work
 - Predict energy use on a national scale
 - Get more insight into how energy is used in homes





A photograph of the London Eye and the River Thames at sunset. The sky is filled with warm orange and red hues. The London Eye's structure is illuminated from within, casting a bright light onto the surrounding water and buildings. In the foreground, several boats are visible on the river. A large, bold white text 'THANK YOU!' is overlaid in the center of the image, partially obscuring the wheel.

THANK YOU!