ENERGY CONSUMPTION PREDICTION

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MIP-ML-13

DATASET DESCRIPTION

household electricity consumption includes essential features such as date, time, global active power, global reactive power, voltage, global intensity, and sub-metering values.

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2075259 entries, 0 to 2075258
Data columns (total 8 columns):
 #   Column                 Dtype
---  ------                 -----
 0   Datetime               datetime64[ns]
 1   Global_active_power    float64
 2   Global_reactive_power  float64
 3   Voltage                float64
 4   Global_intensity       float64
 5   Sub_metering_1         float64
 6   Sub_metering_2         float64
 7   Sub_metering_3         float64
dtypes: datetime64[ns](1), float64(7)
memory usage: 126.7 MB
```

1. Date: Date of the electricity consumption recording.
2. Time: Time of the electricity consumption recording.
3. Global_active_power: Total active power consumed by the household.
4. Global_reactive_power: Total reactive power consumed by the household.
5. Voltage: Voltage level during the electricity consumption period.
6. Global_intensity: Total current intensity consumed by the household.
7. Sub_metering_1: Electricity consumption in sub-metering 1 (e.g., kitchen).
8. Sub_metering_2: Electricity consumption in sub-metering 2 (e.g., laundry).
9. Sub_metering_3: Electricity consumption in sub-metering 3 (e.g., water heater)

EXPLORATORY DATA ANALYSIS

Visualization of Global Active Power and Global Reactive Power Over Time

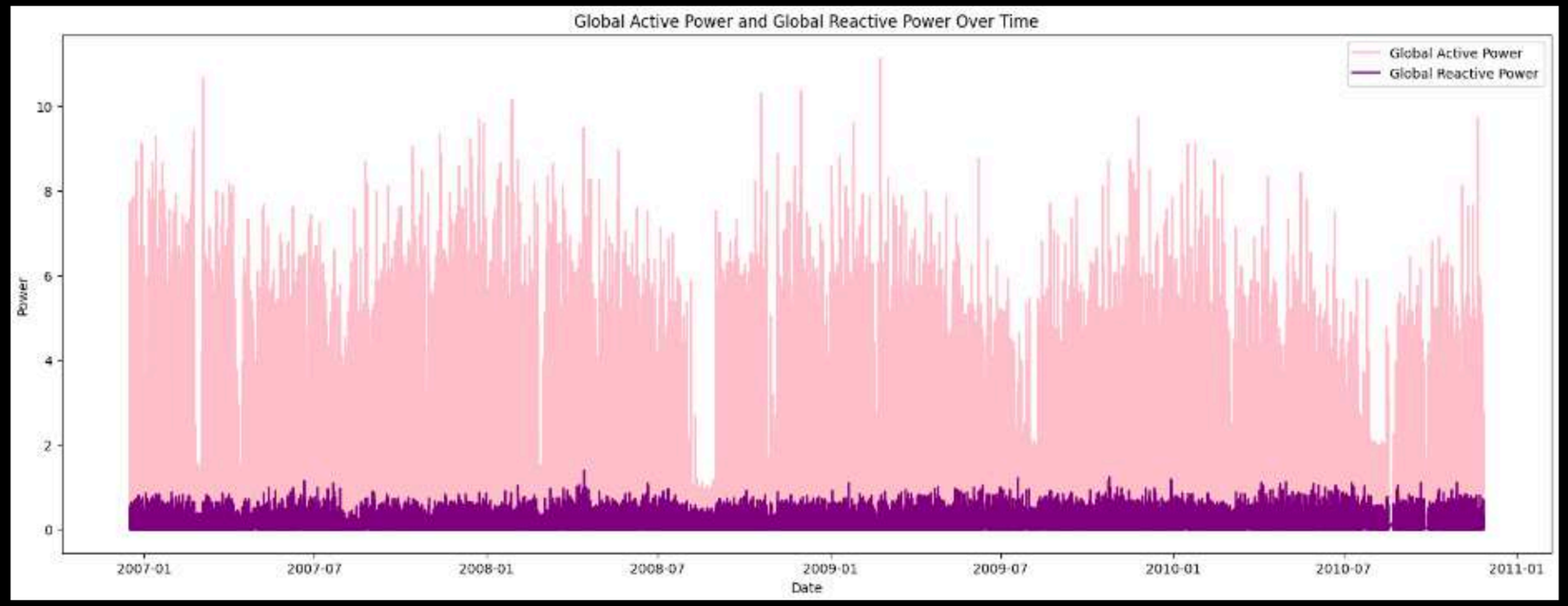
Visualization of Voltage

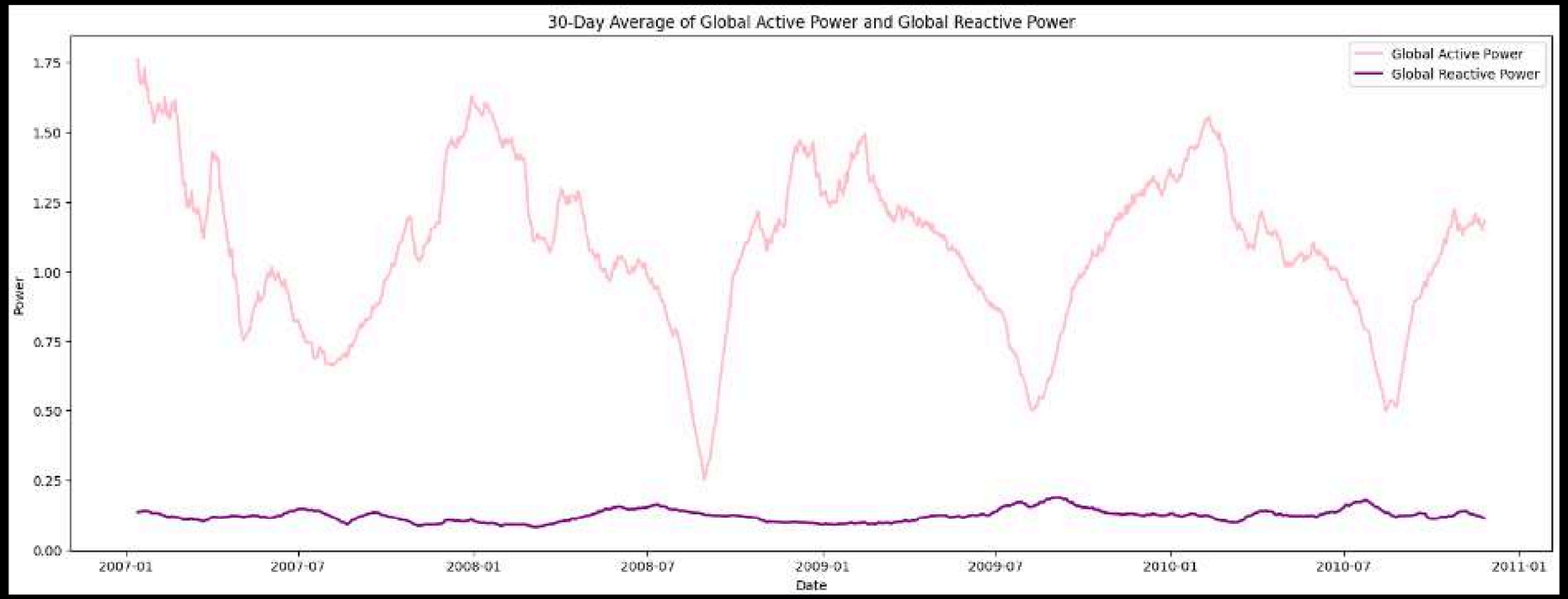
Visualization of Submeter

Visualization of Global Intensity

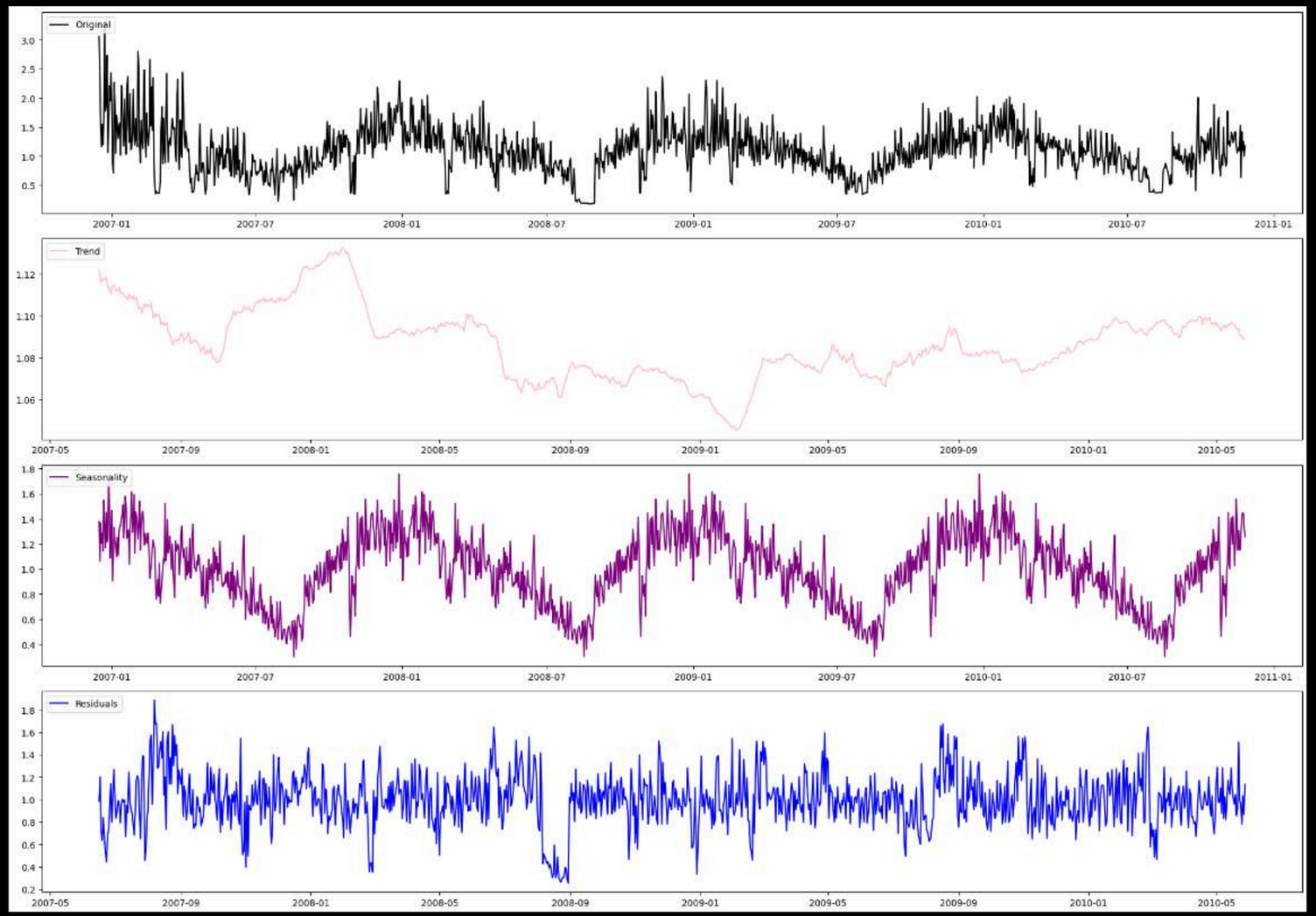
Heatmap Correlation

VISUALIZATION OF ENERGY ACTIVE AND REACTIVE POWER

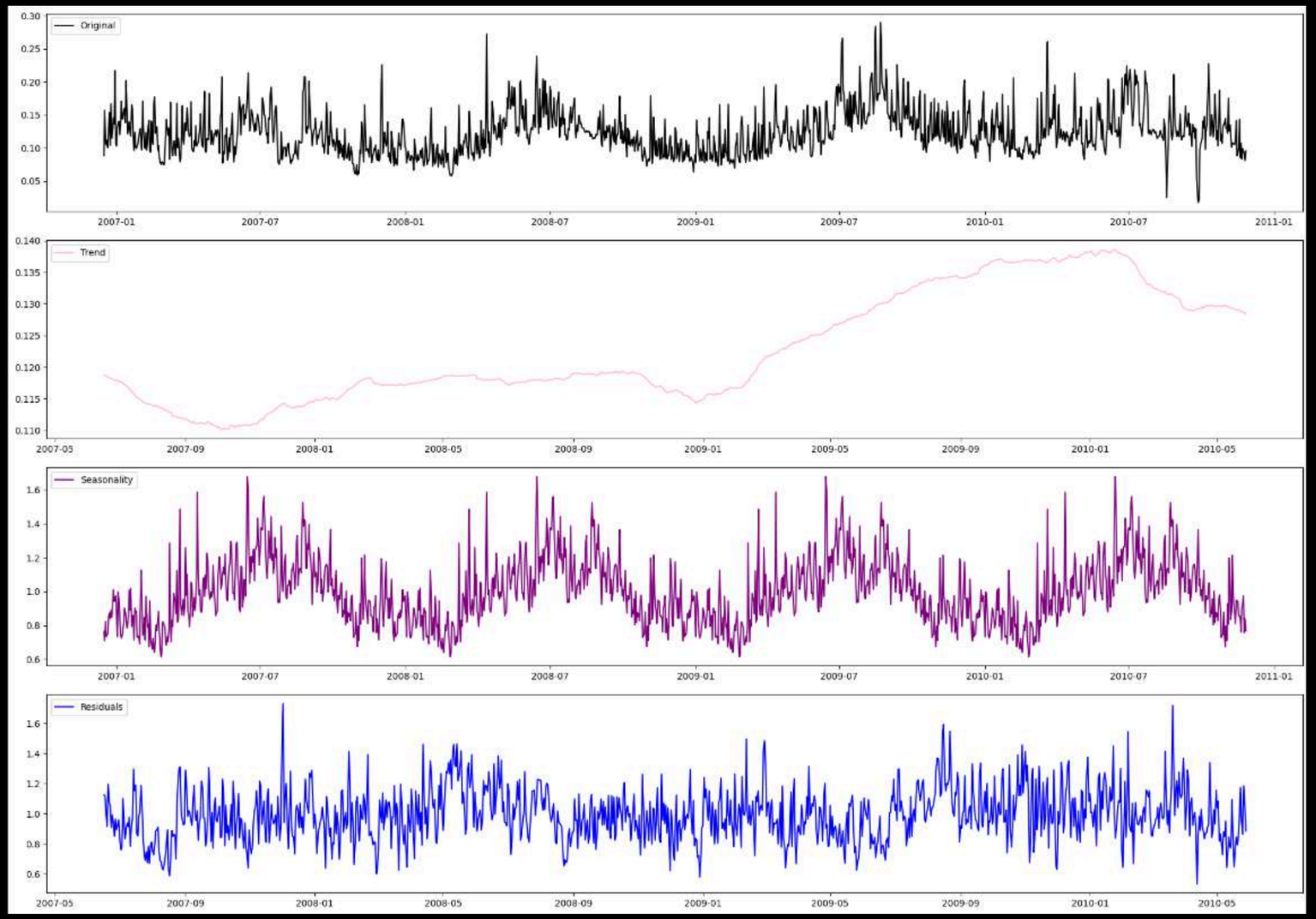



30-Day Average of Global Active Power and Global Reactive Power
Global Active Power
Global Reactive Power
Power
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
2007-01
2007-07
2008-01
2008-07
2009-01
2009-07
2010-01
2010-07
2011-01
Date

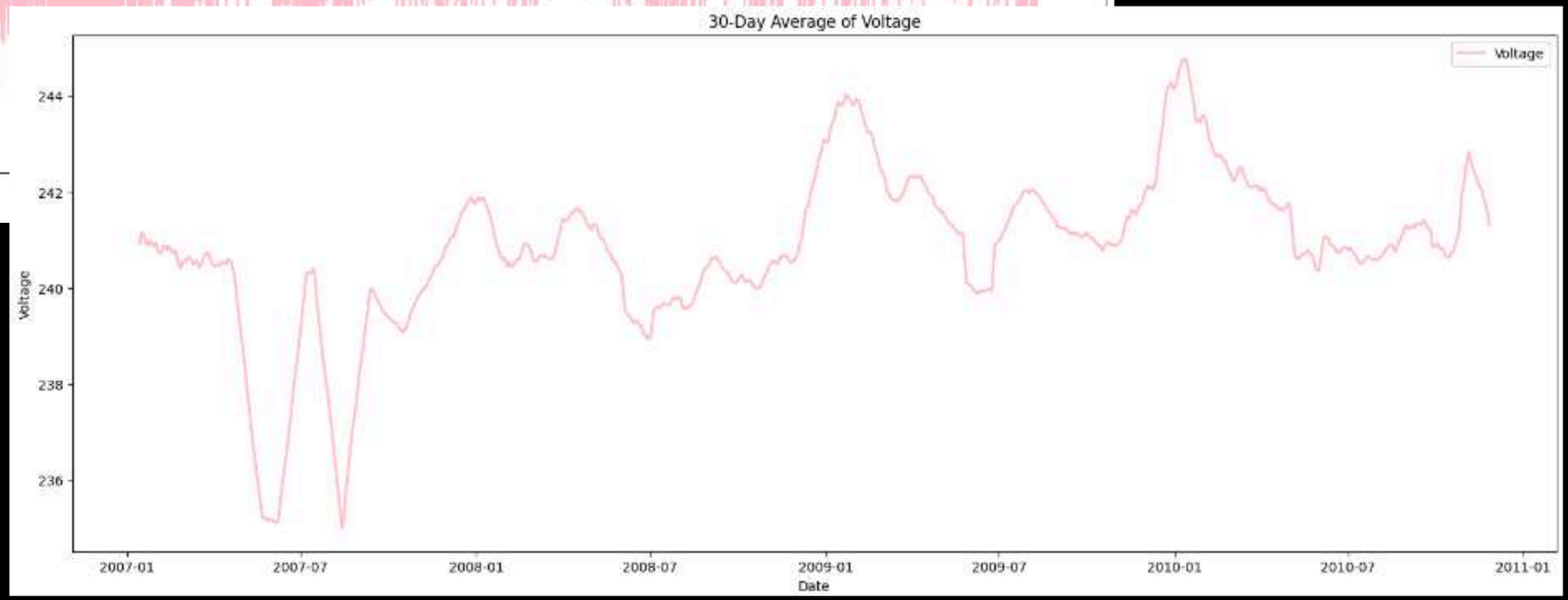
GLOBAL ACTIVE POWER



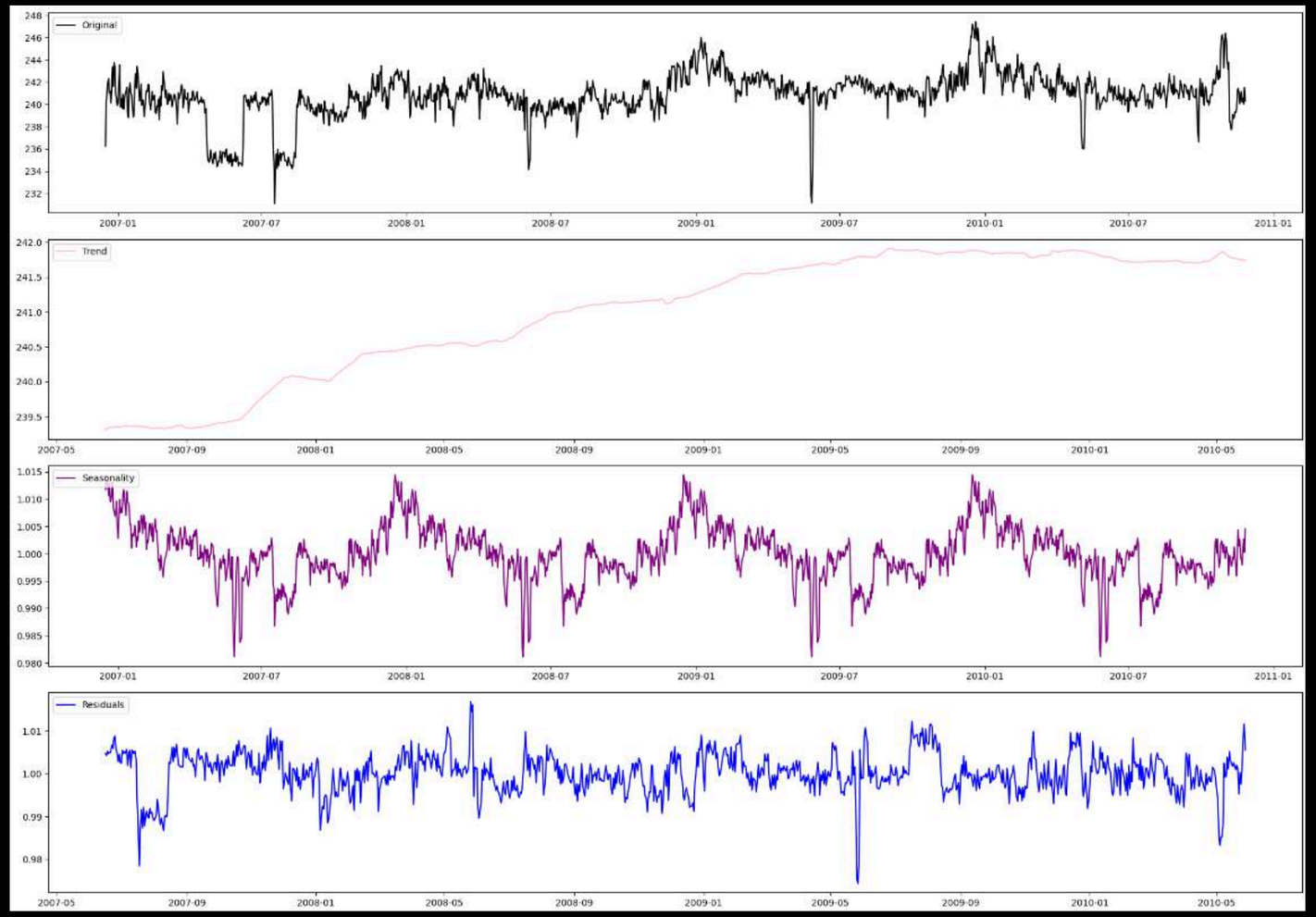
GLOBAL REACTIVE POWER

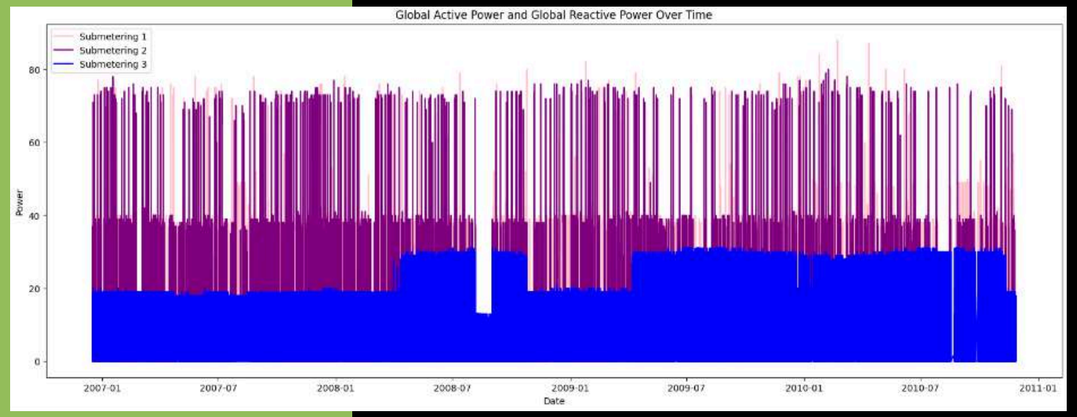


VISUALIZATION OF VOLTAGE

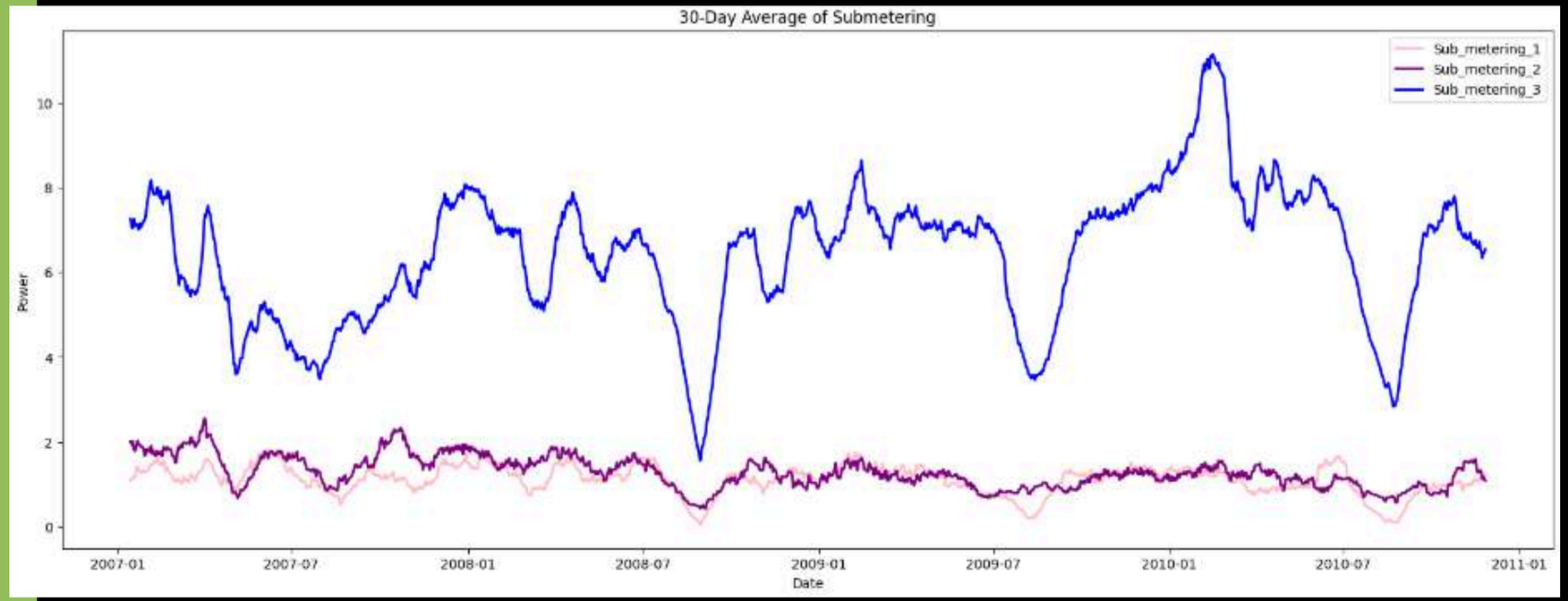


VOLTAGE

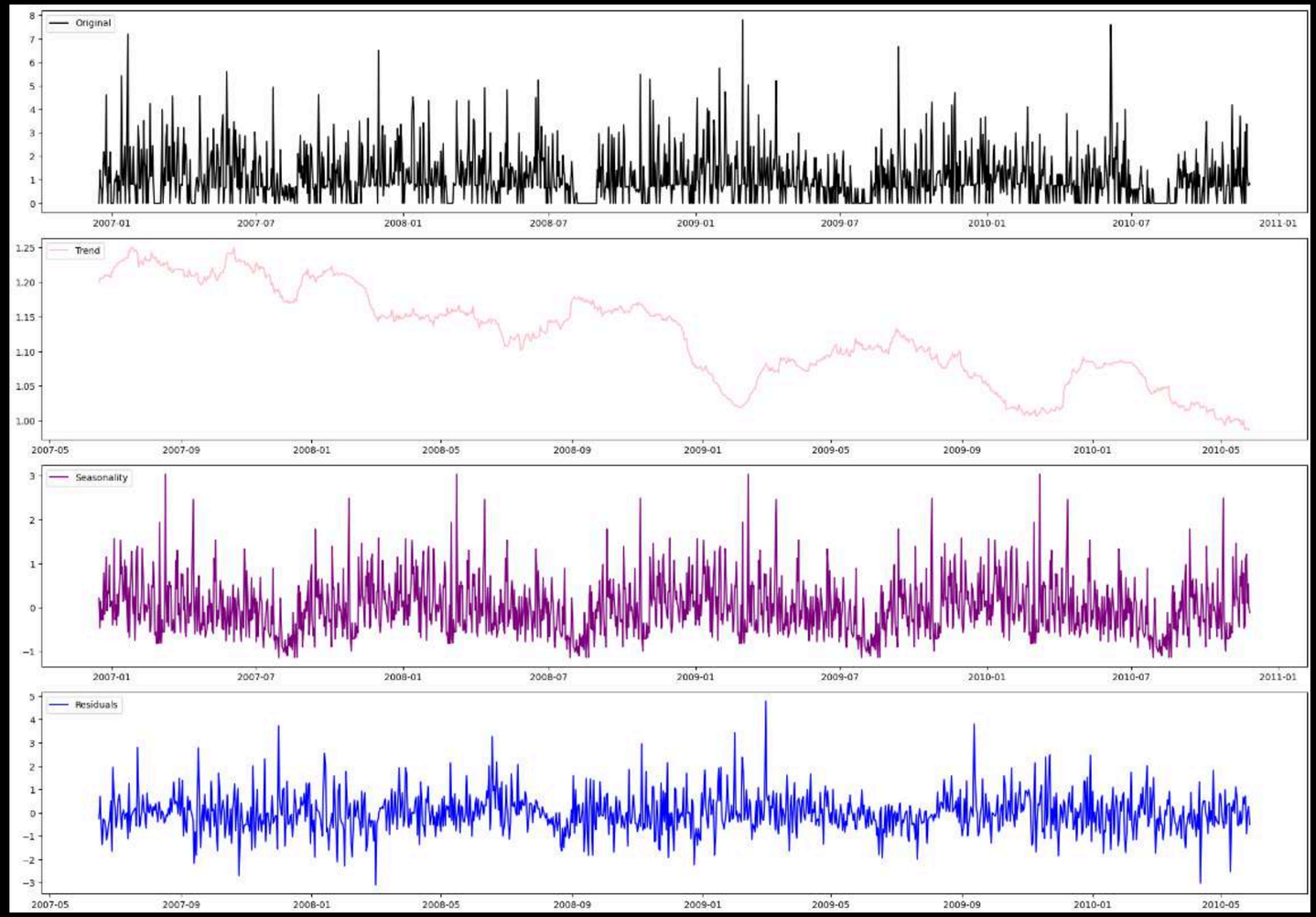




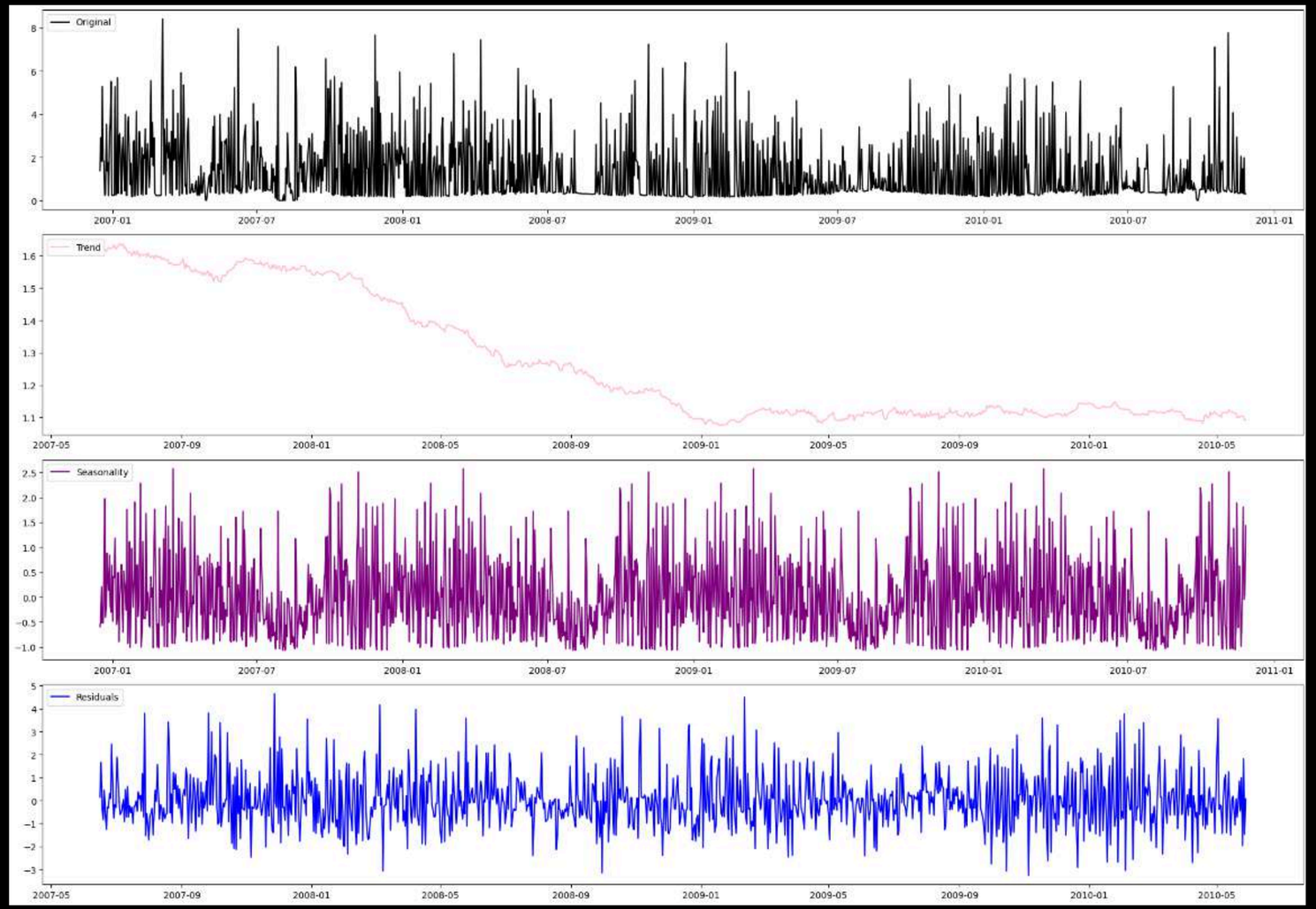
VISUALIZATION OF SUBMETERS



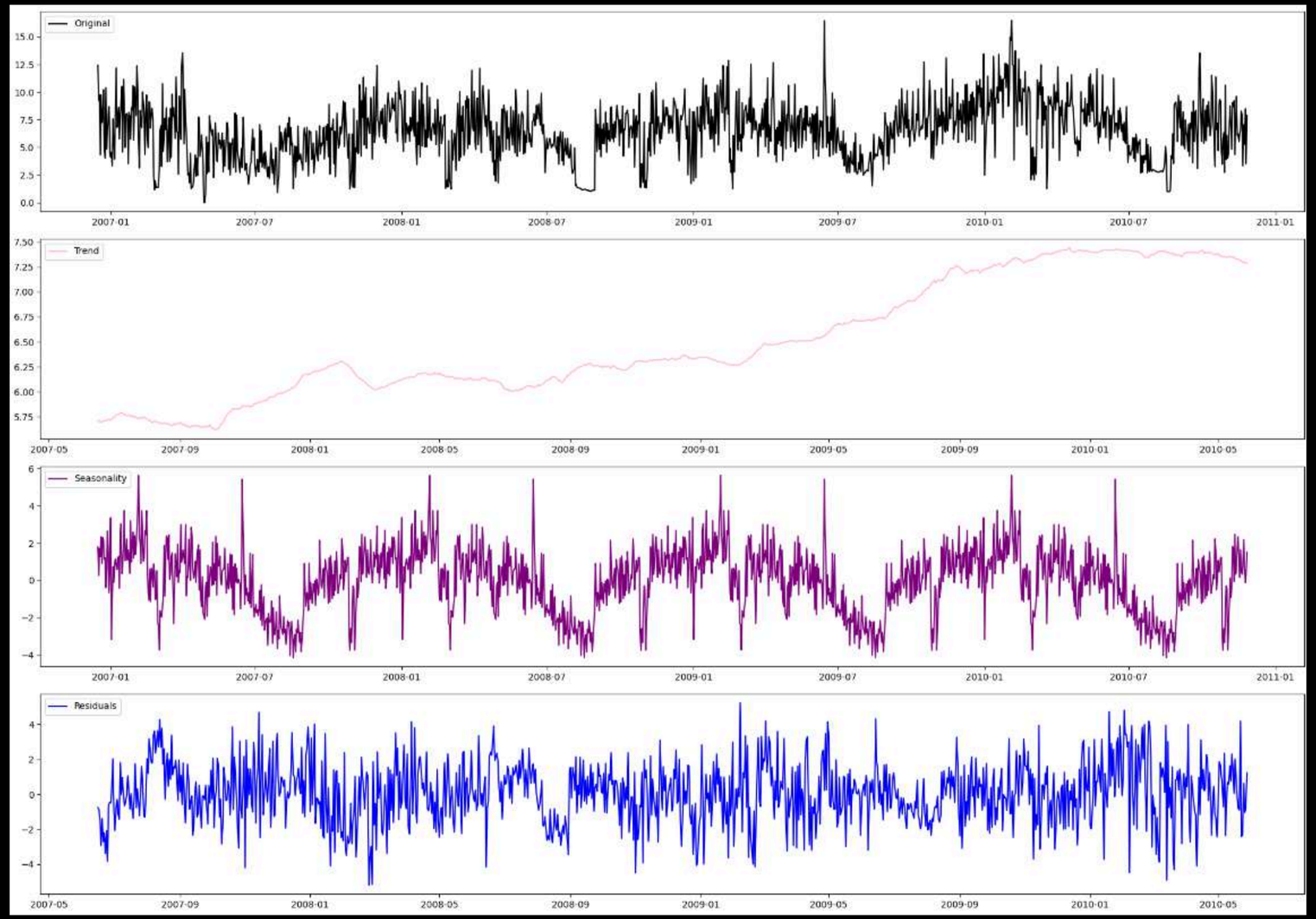
SUBMETER 1 (KITCHEN)

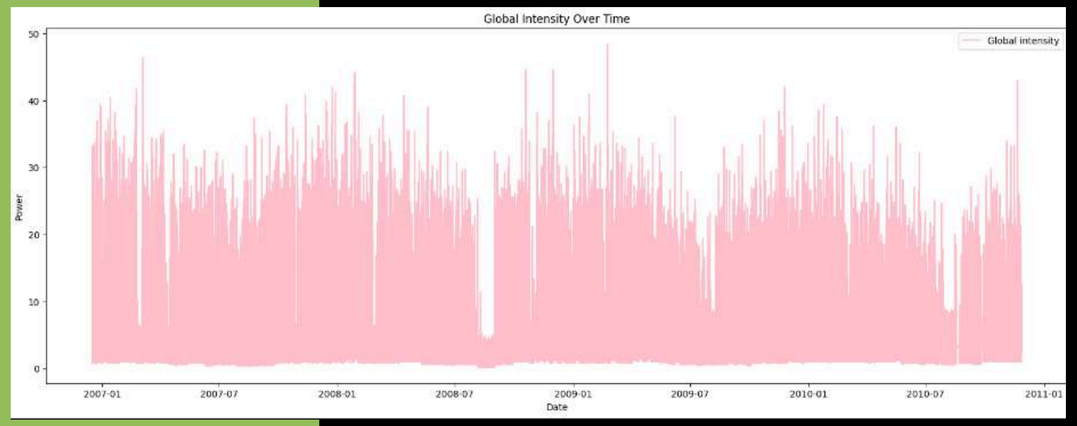


SUBMETER 2 (LAUNDRY)

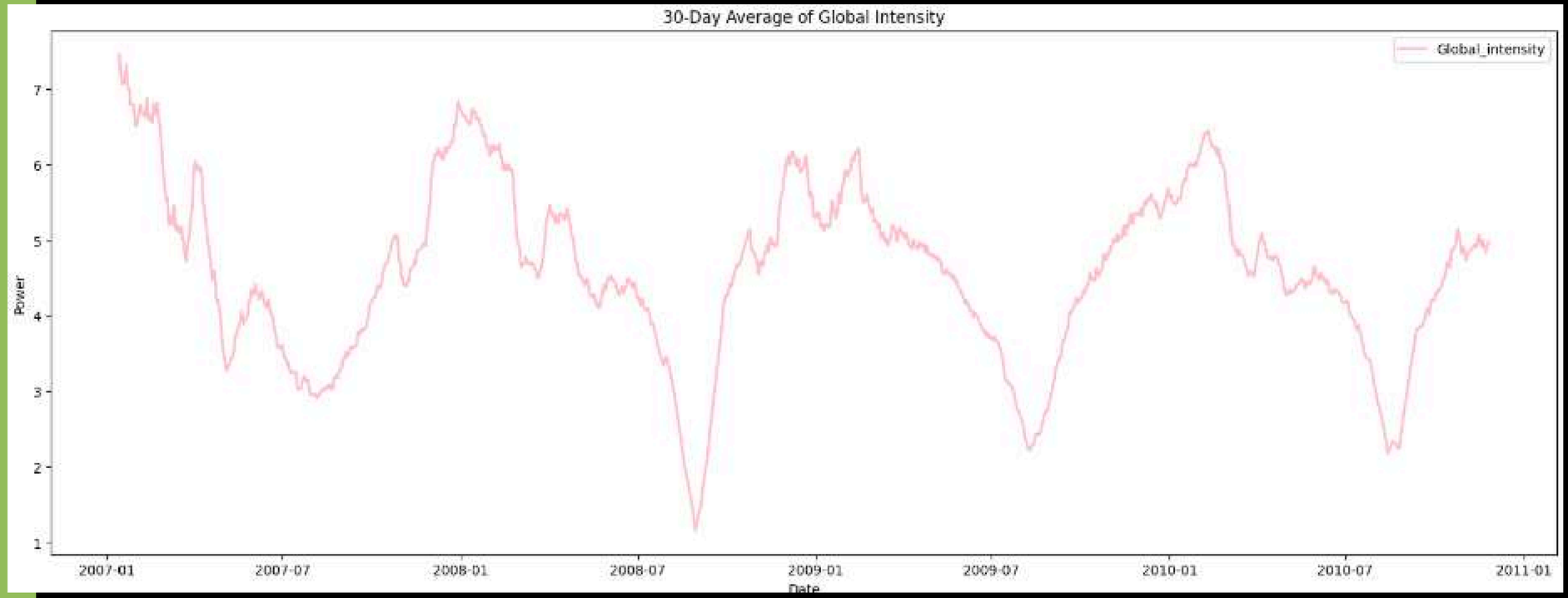


SUBMETER 3 (WATER HEATER)

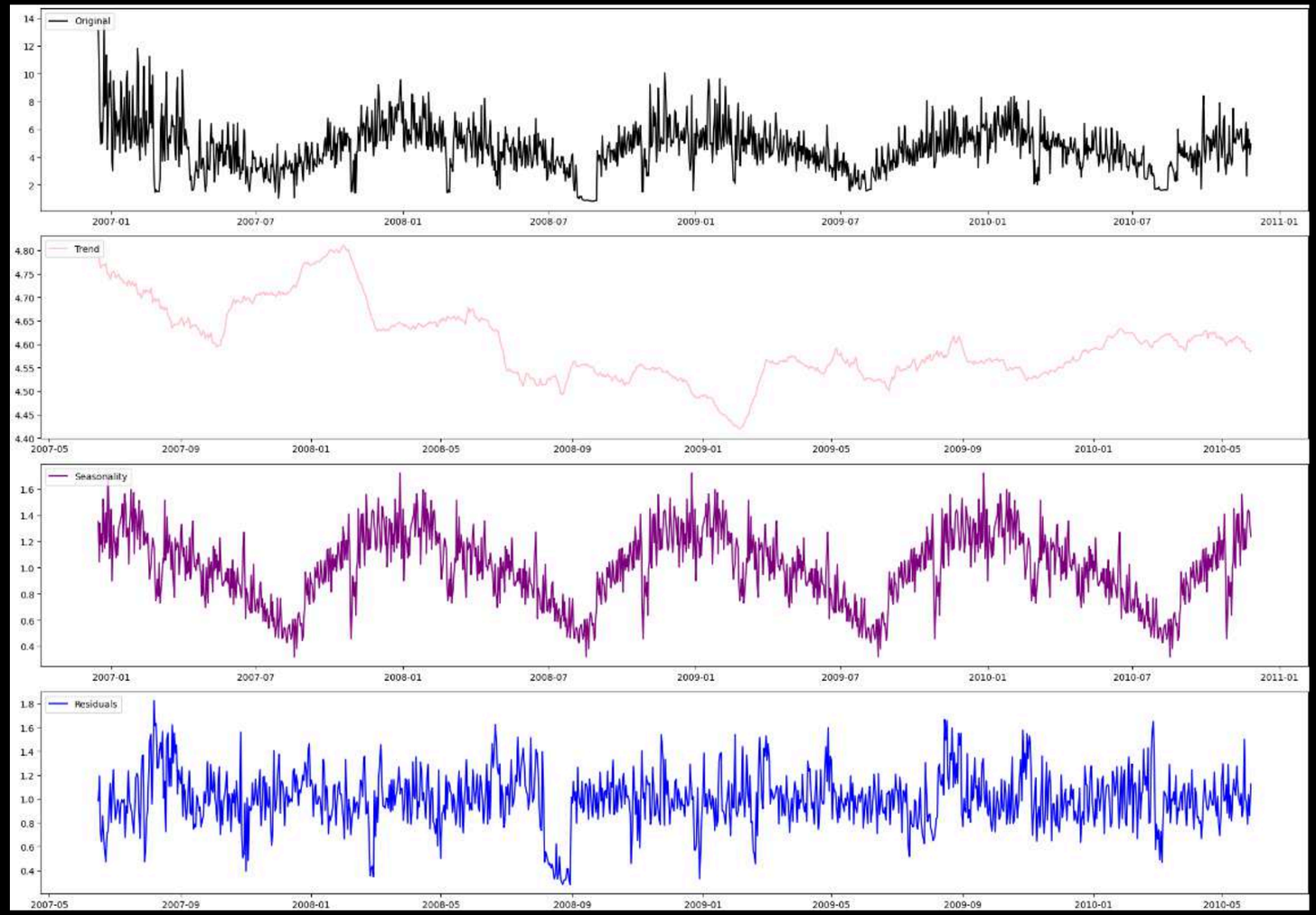




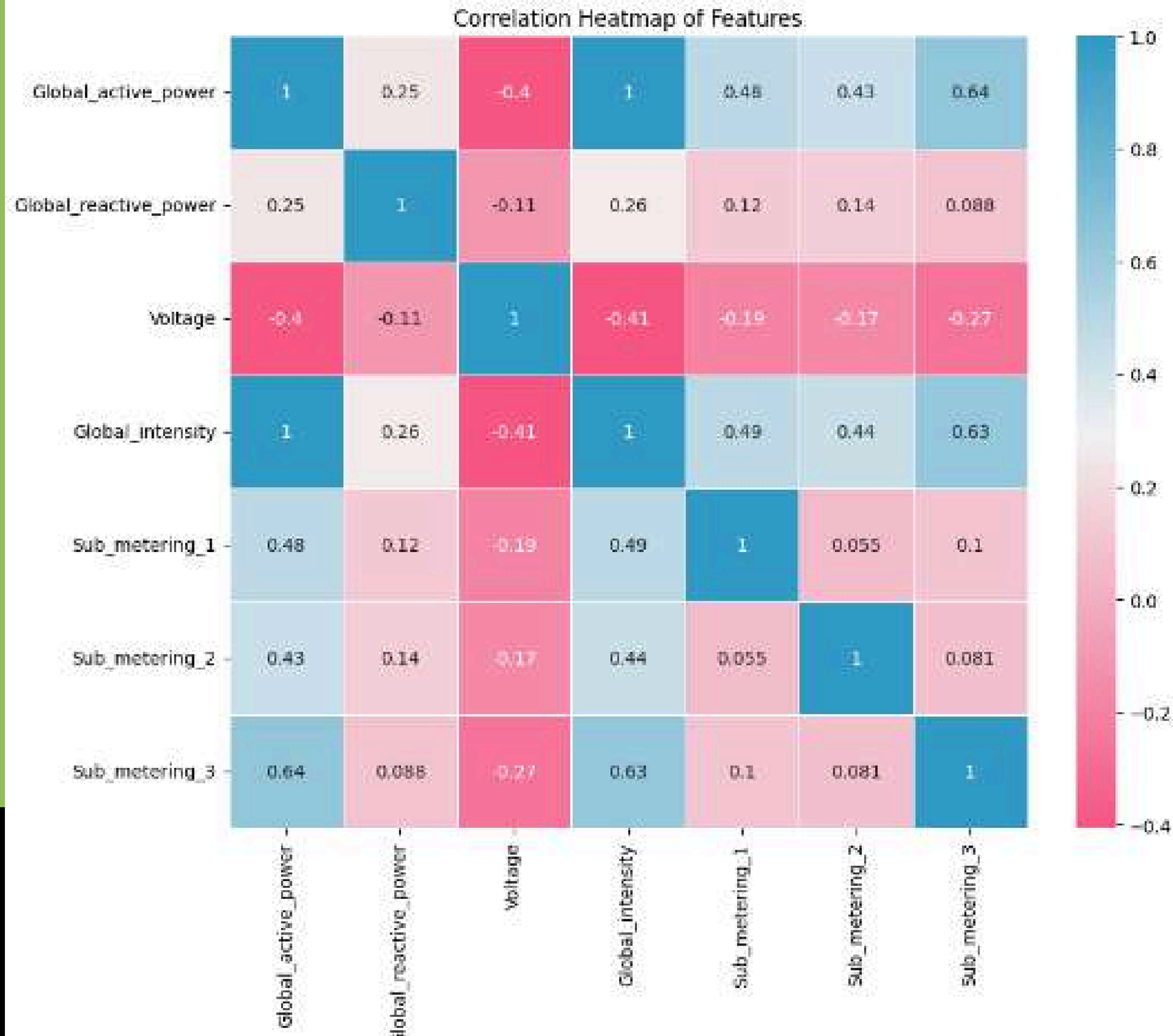
VISUALIZATION OF GLOBAL INTENSITY



GLOBAL INTENSITY



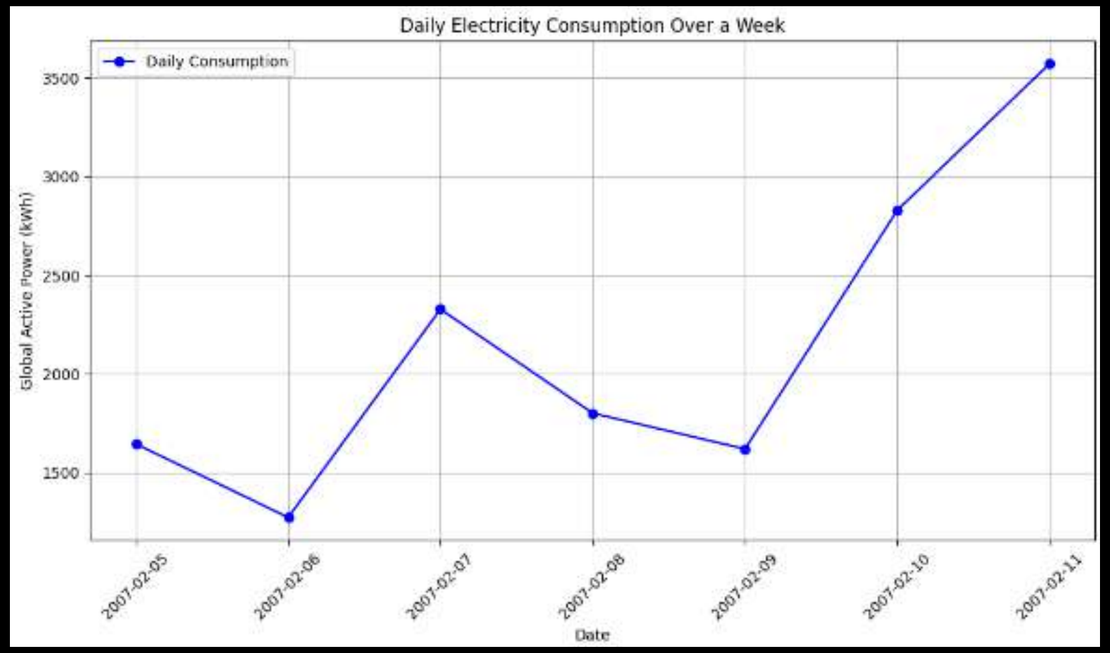
HEATMAP CORRELATION

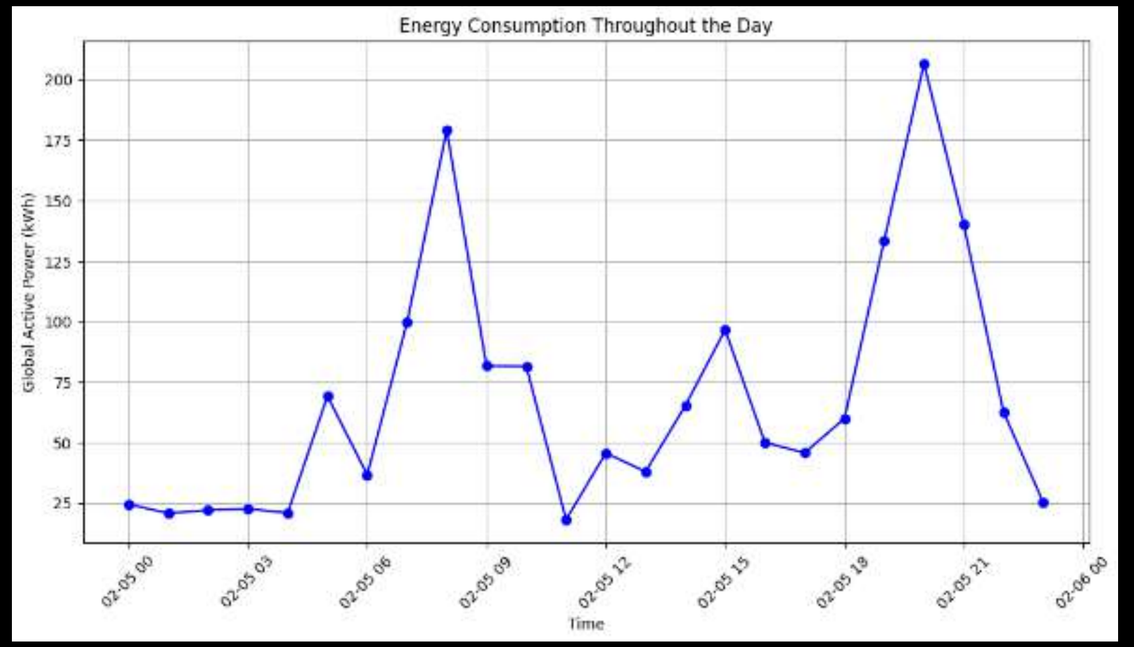


FEATURE ENGINEERING

- Create new feature is_weekend
- Create new feature day_night
- Global active power 50-days average
- Global reactive power 50-days average

FEATURE ENGINEERING





FEATURE ENGINEERING

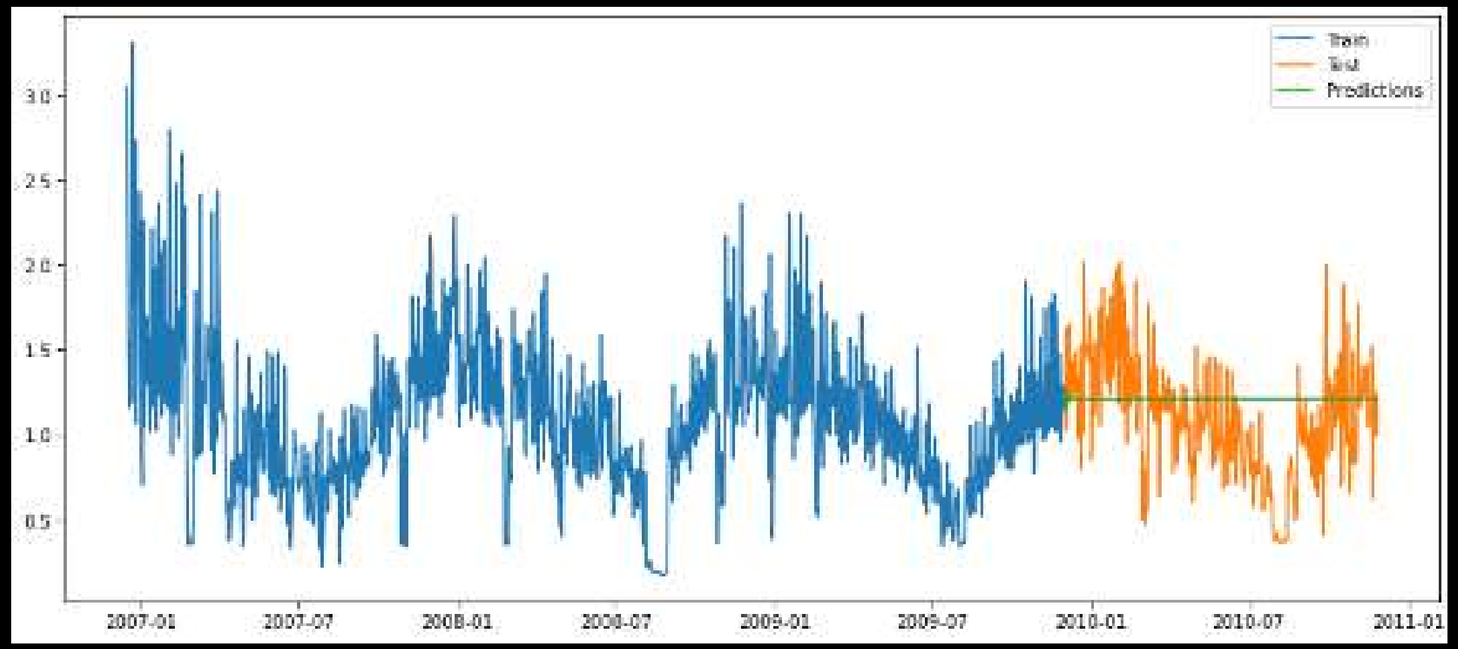
Datetime	Global_active_power	Global_reactive_power	Voltage	Global_intensity	Sub_metering_1	Sub_metering_2	Sub_metering_3	is_weekend	day_night	Global_active_power_50day_avg	Global_reactive_power_50day_avg
2006-12-16 17:24:00	4.216	0.418	234.84	18.4	0.0	1.0	17.0	True	day	4.216000	0.418000
2006-12-16 17:25:00	5.360	0.436	233.63	23.0	0.0	1.0	16.0	True	day	4.788000	0.427000
2006-12-16 17:26:00	5.374	0.498	233.29	23.0	0.0	2.0	17.0	True	day	4.983333	0.450667
2006-12-16 17:27:00	5.388	0.502	233.74	23.0	0.0	1.0	17.0	True	day	5.084500	0.463500
2006-12-16 17:28:00	3.666	0.528	235.68	15.8	0.0	1.0	17.0	True	day	4.800800	0.476400
...	...	...	...	...	...	...	...	...	...	...	...
2010-11-26 20:58:00	0.946	0.000	240.43	4.0	0.0	0.0	0.0	False	night	1.177637	0.125617
2010-11-26 20:59:00	0.944	0.000	240.00	4.0	0.0	0.0	0.0	False	night	1.177612	0.125614
2010-11-26 21:00:00	0.938	0.000	239.82	3.8	0.0	0.0	0.0	False	night	1.177589	0.125614
2010-11-26 21:01:00	0.934	0.000	239.70	3.8	0.0	0.0	0.0	False	night	1.177566	0.125614
2010-11-26 21:02:00	0.932	0.000	239.55	3.8	0.0	0.0	0.0	False	night	1.177544	0.125614

MODEL FORECASTING

ARIMA

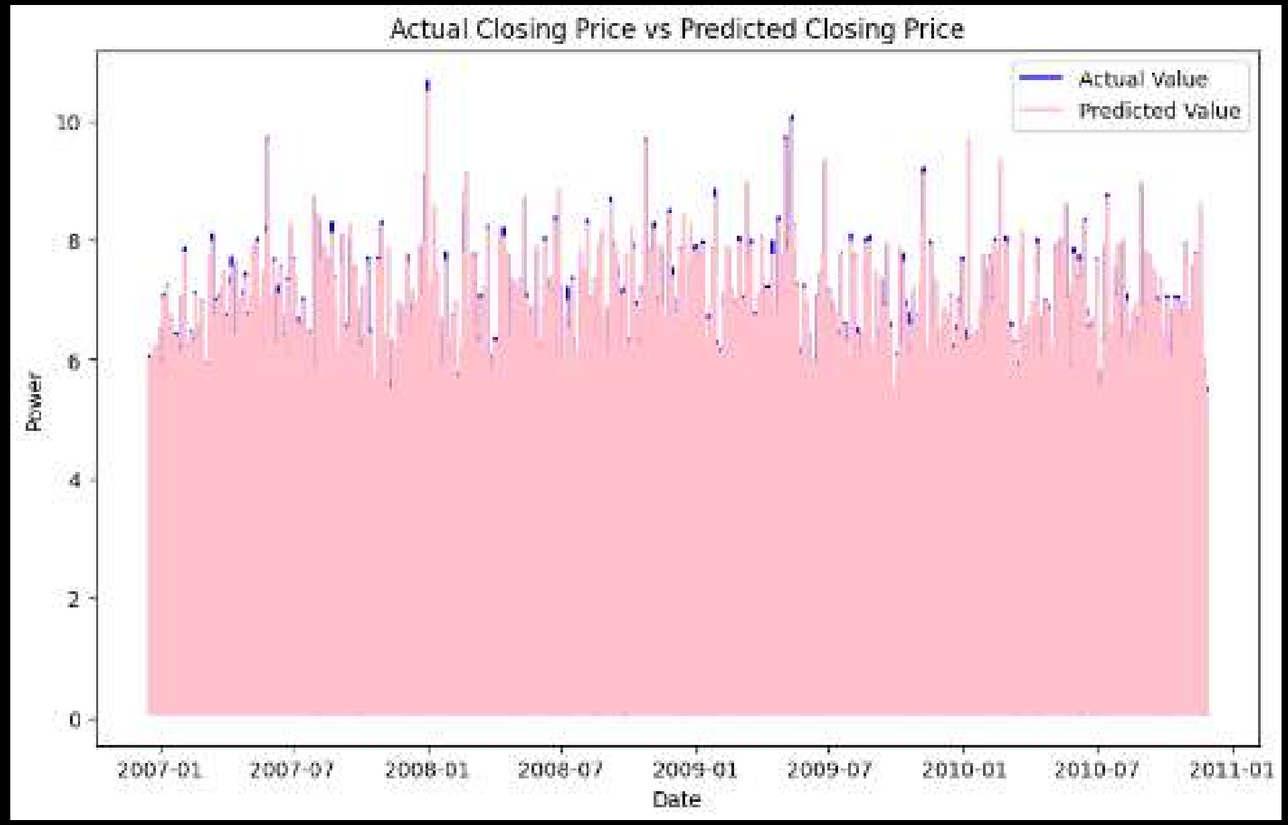
XGBooster

ARIMA MODEL



- p = 5, d=1, q=1
- AIC = 590 (lowest i got)

XGBOOSTER REGRESSION MODEL



- n_estimator = 100, max_depth=9
- r_squared = 0.9993 (highest i got)

Recommendations for Optimizing Electricity Consumption

- Turn off appliances when not in use
- Switch to an energy-efficient appliances
- Wash laundry at washing machine at lower temperature
- Consider switch to renewable energy
- Take advantage of sunlight as much as possible

THANK YOU