Project 4: Measure Energy Consumption

PHASE-4 PROJECT SUBMISSION

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Objective:

The objective of this project is to create an automated system that measures energy consumption, analyzes the data, and provides visualizations for informed decision-making. This solution aims to enhance efficiency, accuracy, and ease of understanding in managing energy consumption across various sectors.

In this phase we concentrate on analyzing and visualizing the preprocessed data that we got from the previous phase.

Loading Preprocessed Data:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

# Load the preprocessed dataset
data = pd.read_csv('preprocessed_data.csv')
data
```

Output:

	Datetime	PJMW_MW	PJME_MW	PJM_Load_MW	PJM_Load	NI_MW	FE_MW	AEP_MW	COMED_MW	DEOK_MW	DOM_MW	DUQ
0	2002-12-31 01:00:00	-5.405996e-01	-0.863588	-1.643803e-01	29309.000000	-1.257964e+00	-1.793401	-8.540702e-01	-0.930547	-4.234802e-01	-0.722944	-7.35376
1	2002-12-31 02:00:00	-6.825986e-01	-1.072592	-5.499718e-01	28236.000000	-1.795947e+00	-2.077804	-1.113057e+00	-1.278343	-6.271573e-01	-0.870757	-1.031987
2	2002-12-31 03:00:00	-7.381635e-01	-1.161237	-7.454627e-01	27692.000000	-2.123126e+00	-2.300528	-1.234734e+00	-1.515126	-7.752860e-01	-0.902729	-1.127195
3	2002-12-31 04:00:00	-7.669749e-01	-1.189238	-7.799611e-01	27596.000000	-2.276740e+00	-2.381623	-1.260083e+00	-1.670415	-7.752860e-01	-0.883731	-1.182123
4	2002-12-31 05:00:00	-6.918594e-01	-1.116992	-6.750285e-01	27888.000000	-2.402425e+00	-2.399898	-1.195442e+00	-1.717900	-6.483185e-01	-0.842028	-1.108886
...	...	...	...	...	...	...	...	...	...	...	...	
145361	NaN	9.358504e-16	1.887964	2.614676e-15	29766.427408	2.419247e-15	0.000000	7.685056e-16	0.000000	2.405756e-15	0.000000	-8.32610
145362	NaN	9.358504e-16	1.805507	2.614676e-15	29766.427408	2.419247e-15	0.000000	7.685056e-16	0.000000	2.405756e-15	0.000000	-8.32610
145363	NaN	9.358504e-16	1.596812	2.614676e-15	29766.427408	2.419247e-15	0.000000	7.685056e-16	0.000000	2.405756e-15	0.000000	-8.32610

Analysis:

descriptive_stats = data.describe()
print(descriptive_stats)

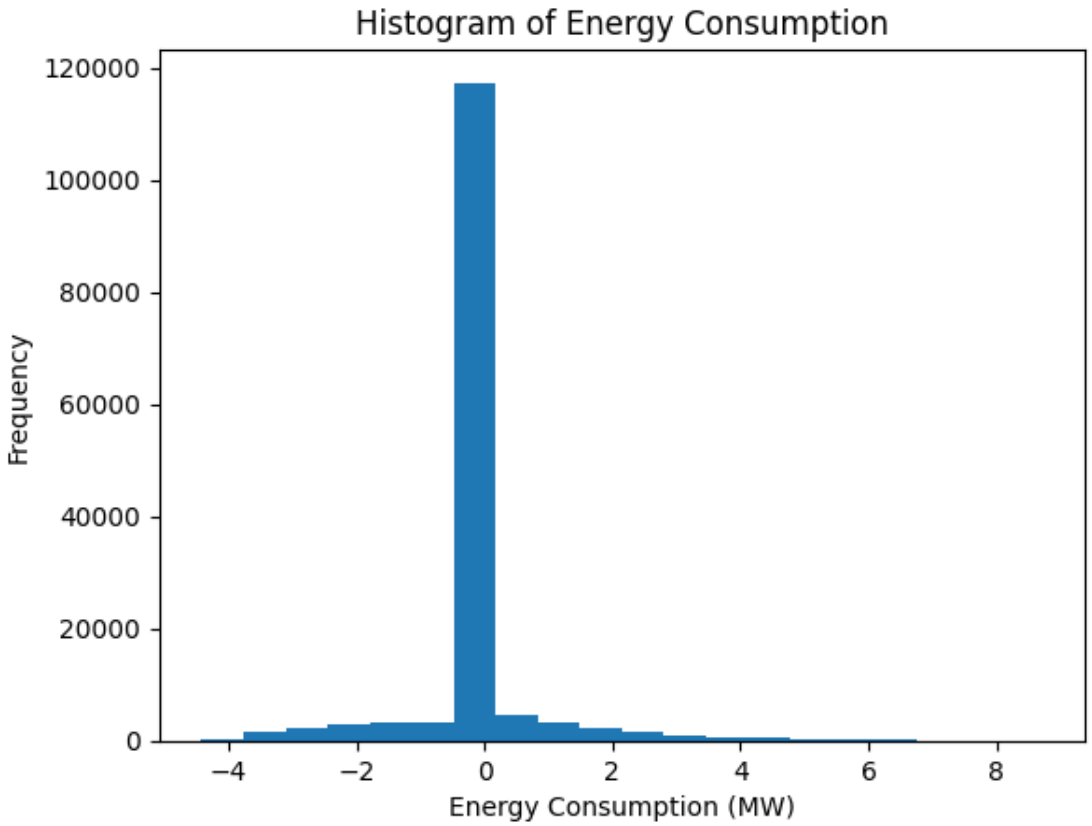
Output:

```
              PJMW_MW       PJME_MW    PJM_Load_MW       PJM_Load          NI_MW  \
count  1.453660e+05  1.453660e+05  1.453660e+05  145366.000000  1.453660e+05
mean   6.162736e-16  2.142880e-16  2.712602e-15   29766.427408  2.333922e-15
std    1.000003e+00  1.000003e+00  1.000003e+00    2782.747534  1.000003e+00
min   -5.263611e+00 -2.712910e+00 -4.422058e+00   17461.000000 -3.124612e+00
25%   -7.042072e-01 -6.972818e-01  2.614676e-15   29766.427408  2.419247e-15
50%   -5.389284e-02 -1.019839e-01  2.614676e-15   29766.427408  2.419247e-15
75%    6.540443e-01  5.522560e-01  2.614676e-15   29766.427408  2.419247e-15
max    4.107296e+00  4.630078e+00  8.719316e+00   54030.000000  7.932966e+00

              FE_MW       AEP_MW      COMED_MW       DEOK_MW       DOM_MW  \
count  1.453660e+05  1.453660e+05  1.453660e+05  1.453660e+05  1.453660e+05
mean   8.524597e-17  6.444297e-16 -6.647621e-18  2.450472e-15 -9.384877e-18
std    1.000003e+00  1.000003e+00  1.000003e+00  1.000003e+00  1.000003e+00
min   -8.900034e+00 -2.500515e+00 -2.684285e+00 -5.814309e+00 -4.492880e+00
25%    0.000000e+00 -6.331077e-01 -4.244911e-02  2.405756e-15 -6.154429e-01
50%    0.000000e+00  7.685056e-16  0.000000e+00  2.405756e-15  0.000000e+00
75%    0.000000e+00  5.219811e-01  0.000000e+00  2.405756e-15  3.946925e-01
max    7.127010e+00  4.307495e+00  7.913858e+00  6.189411e+00  4.958837e+00

              DUQ_MW       EKPC_MW
count  1.453660e+05  1.453660e+05
mean  -1.164258e-15  2.307902e-15
std    1.000003e+00  1.000003e+00
min   -2.361243e+00 -4.491167e+00
25%   -6.255203e-01  2.149344e-15
50%   -8.326109e-16  2.149344e-15
75%    4.034628e-01  2.149344e-15
max    5.108955e+00  9.574772e+00
```

Visualization:

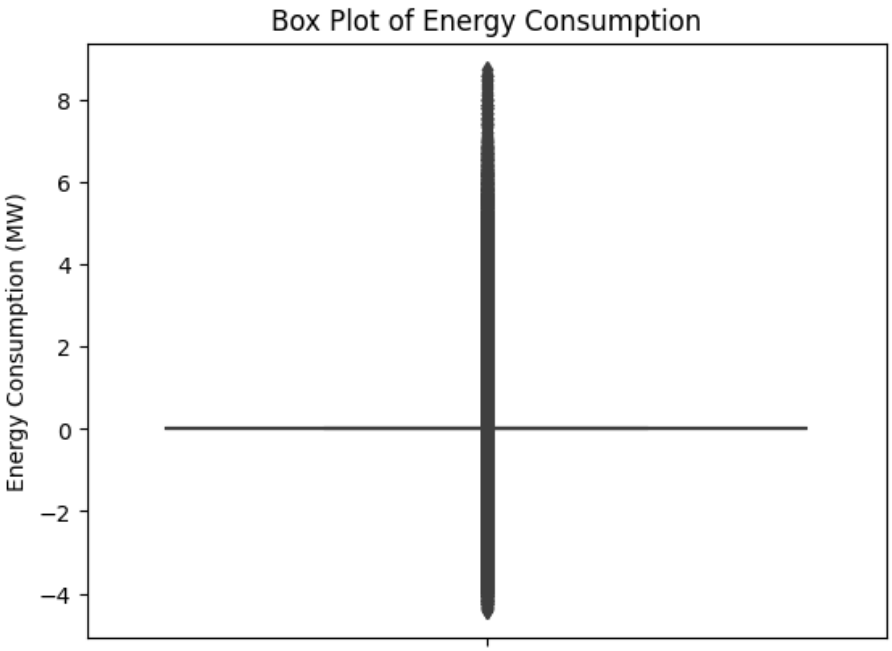
1.Histogram:

```
plt.hist(data['PJM_Load_MW'], bins=20)
plt.xlabel('Energy Consumption (MW)')
plt.ylabel('Frequency')
plt.title('Histogram of Energy Consumption')
plt.show()
```



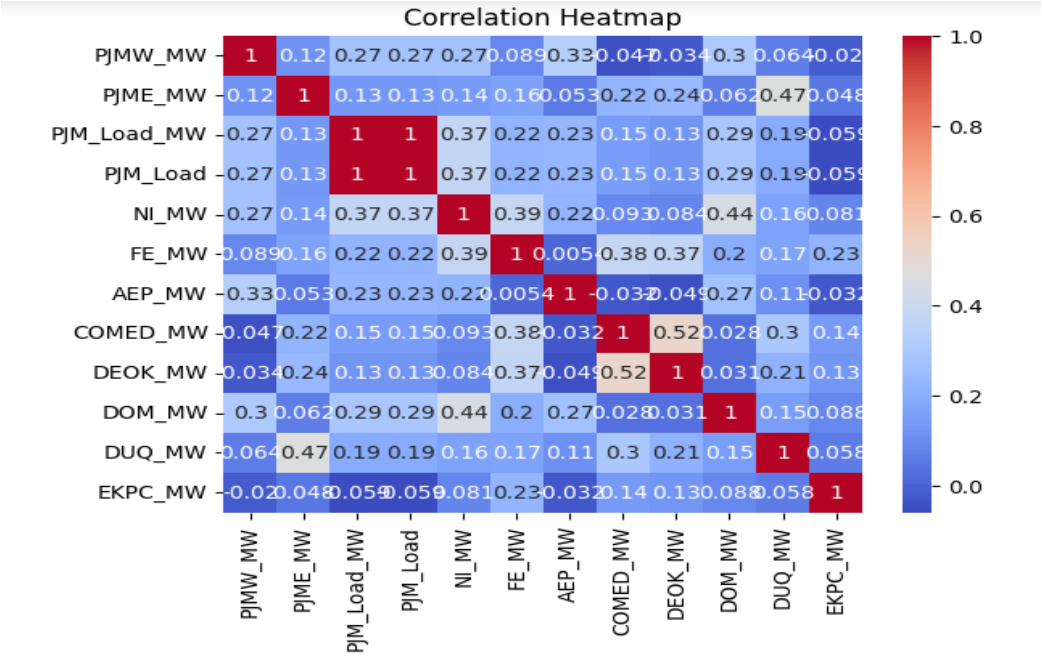
2.Box Plot:

```
import seaborn as sns

sns.boxplot(data=data, y='PJM_Load_MW')
plt.ylabel('Energy Consumption (MW)')
plt.title('Box Plot of Energy Consumption')
plt.show()
```



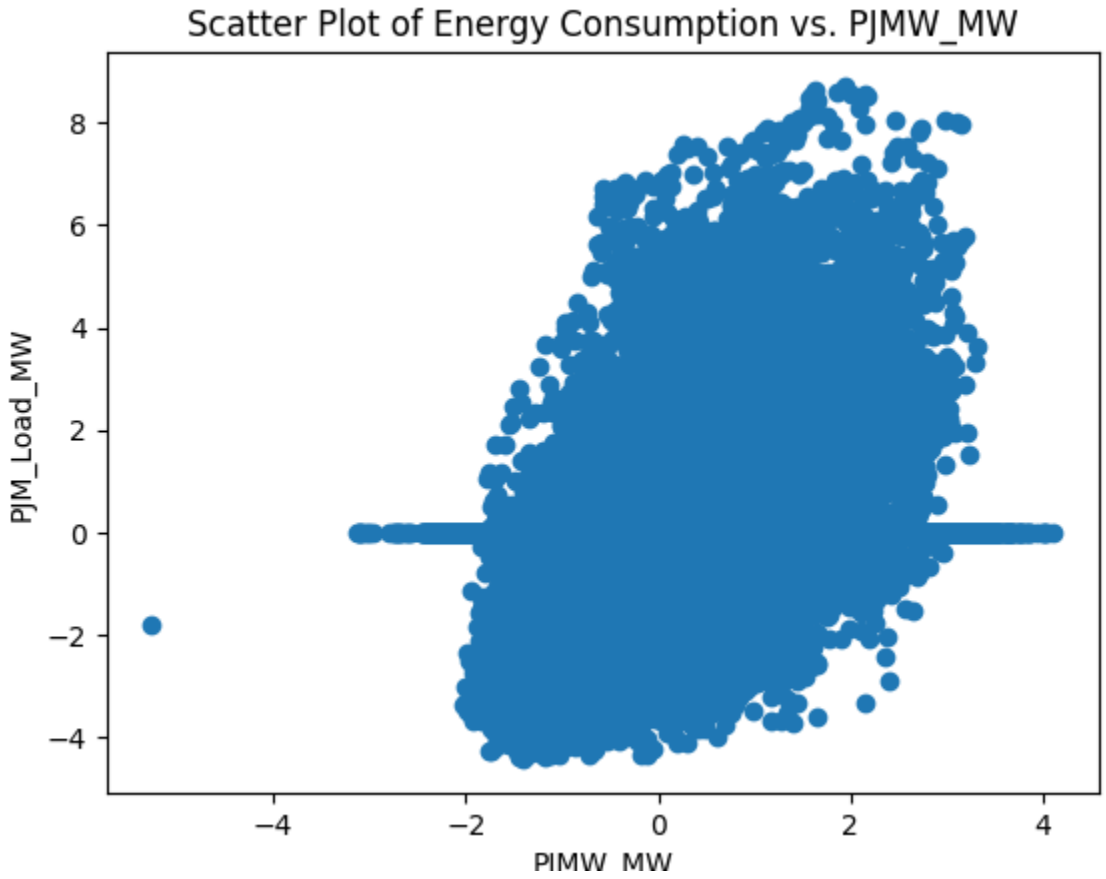
3.Correlation Heatmap:

```
correlation_matrix = data.corr()
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm')
plt.title('Correlation Heatmap')
plt.show()
```



4.Scatter Plot:

```
import matplotlib.pyplot as plt

plt.scatter(data['PJMW_MW'], data['PJM_Load_MW'])
plt.xlabel('PJMW_MW')
plt.ylabel('PJM_Load_MW')
plt.title('Scatter Plot of Energy Consumption vs. PJMW_MW')
plt.show()
```



Conclusion:

In this phase of project development we have successfully completed the analysis and created various types of visualizations for the preprocessed data that is acquired from the previous phase.The values we got from analysis is convincing and ready for the next step.