```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import silhouette_score

# Load the dataset
data = pd.read_csv('environmental factors.csv')
data.head()
```

```
   temperature   humidity  wind_speed  carbon_emissions
solar_irradiance  \
0    22.490802  52.418449   19.599966        337.165056
369.020837
1    34.014286  49.974726    8.690240        256.681604
185.335998
2    29.639879  40.569235   11.932794        484.024336
213.723302
3    26.973170  66.436000   18.265613        148.540303
262.604015
4    18.120373  58.597450   14.641787        314.535387
283.288001

   pollution_level
0        84.723658
1        49.451704
2        19.546561
3        73.664179
4        41.867814
```

```python
# Normalize the features using StandardScaler
scaler = StandardScaler()
data_scaled = scaler.fit_transform(data)
# Display scaled data
print(pd.DataFrame(data_scaled, columns=data.columns).head())
```

```
   temperature  humidity  wind_speed  carbon_emissions
solar_irradiance  \
0    -0.415900 -0.452465    0.801884          0.482494          -
0.684316
1     1.587377 -0.593258   -1.100359         -0.136414          -
1.389866
2     0.826917 -1.135149   -0.534981          1.611824          -
1.280827
3     0.363328  0.355146    0.569224         -0.968007          -
1.093072
4    -1.175669 -0.096466   -0.062635          0.308475          -
1.013623
```

```
   pollution_level
0         1.193409
1        -0.029923
2        -1.067119
3         0.809835
4        -0.292954
```

```
data_subset =
data[['temperature','humidity','wind_speed','carbon_emissions','pollut
ion_level']]
```

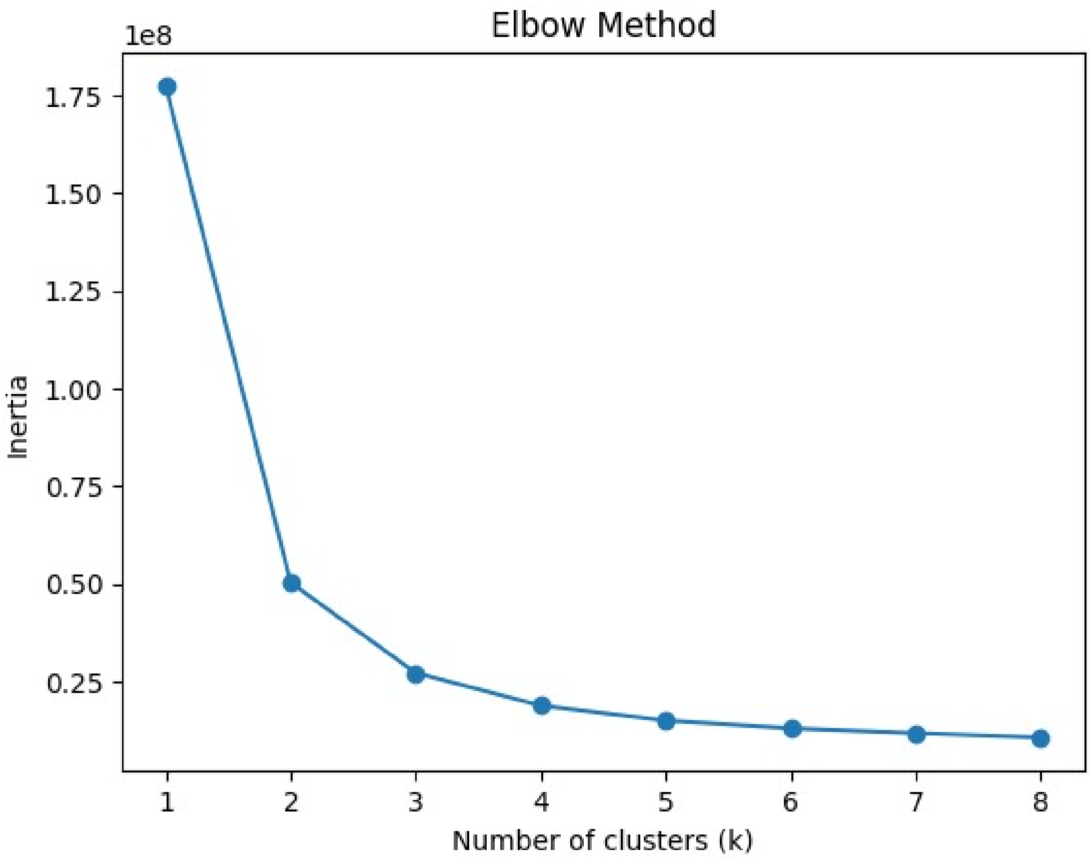
```
data = pd.read_csv('environmental factors.csv')
subset_df = data.iloc[:, :2]
print(subset_df.head())
```

```
   temperature   humidity
0    22.490802  52.418449
1    34.014286  49.974726
2    29.639879  40.569235
3    26.973170  66.436000
4    18.120373  58.597450
```

```
# Use the Elbow method to find the optimal number of clusters
inertia = []
k_range = range(1, 9)

for k in k_range:
    kmeans = KMeans(n_clusters=k, random_state=42)
    kmeans.fit(data_subset)
    inertia.append(kmeans.inertia_)

# Plot the inertia values to find the "elbow"
plt.plot(k_range, inertia, marker='o')
plt.title('Elbow Method')
plt.xlabel('Number of clusters (k)')
plt.ylabel('Inertia')
plt.show()
```




```
data_subset = data[['carbon_emissions', 'pollution_level']]
scaled_data = StandardScaler().fit_transform(data_subset)

# Applying K-Means clustering with k=5
k = 5
kmeans = KMeans(n_clusters=k, random_state=42)
data['cluster'] = kmeans.fit_predict(data_subset)

# Display the first few rows with cluster labels
print(data.head())
```

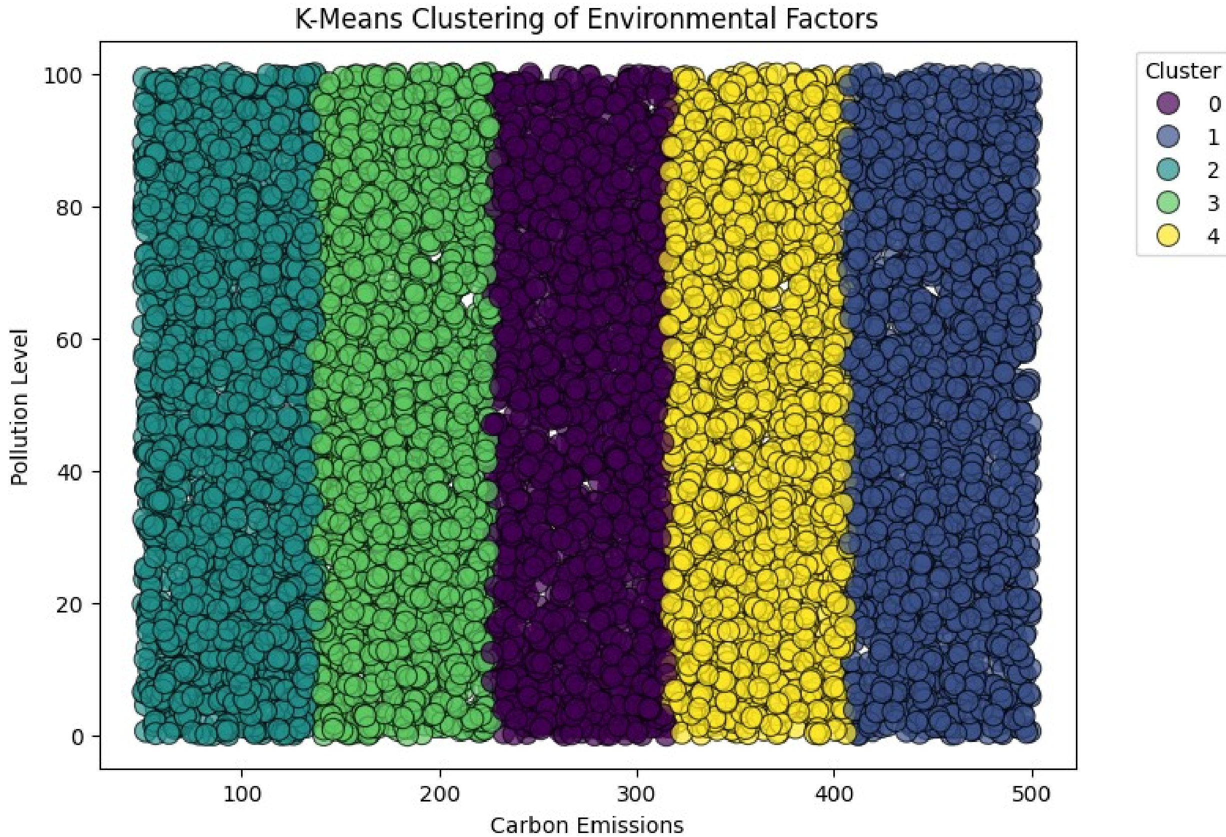
```
   temperature   humidity  wind_speed  carbon_emissions
solar_irradiance  \
0    22.490802  52.418449   19.599966        337.165056
369.020837
1    34.014286  49.974726    8.690240        256.681604
185.335998
2    29.639879  40.569235   11.932794        484.024336
213.723302
3    26.973170  66.436000   18.265613        148.540303
262.604015
4    18.120373  58.597450   14.641787        314.535387
283.288001
```

```
   pollution_level  cluster
0        84.723658        4
1        49.451704        0
2        19.546561        1
3        73.664179        3
4        41.867814        0
```

```
# Calculate Silhouette Score
sil_score = silhouette_score(data_subset, data['cluster'])
print(f'Silhouette Score: {sil_score}')
```

```
Silhouette Score: 0.40274104158400853
```

```
import seaborn as sns
import matplotlib.pyplot as plt
# Assuming `data` already contains the cluster labels (from the KMeans
model)
# We'll use two features to plot: 'carbon_emissions' and
'pollution_level'
plt.figure(figsize=(8, 6))
# Create a scatter plot with the cluster labels
sns.scatterplot(x='carbon_emissions', y='pollution_level',
hue='cluster',
                data=data, palette='viridis', s=100, alpha=0.7,
edgecolor='k')
# Title and labels
plt.title('K-Means Clustering of Environmental Factors')
plt.xlabel('Carbon Emissions')
plt.ylabel('Pollution Level')
plt.legend(title='Cluster', bbox_to_anchor=(1.05, 1), loc='upper
left')
# Display the plot
plt.show()
```


K-Means Clustering of Environmental Factors
Pollution Level
Carbon Emissions
0
20
40
60
80
100
100
200
300
400
500
Cluster
0
1
2
3
4