EnergyConsumption

June 21, 2024

[42]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

[43]:
```
df = pd.read_csv("Energy_consumption.csv")
```

[44]:
```
df.head()
```

[44]:

	Timestamp	Temperature	Humidity	SquareFootage	Occupancy	HVACUsage	LightingUsage	RenewableEnergy	DayOfWeek	Holiday	EnergyConsumption
0	2022-01-01 00:00:00	25.139433	43.431581	1565.693999	5	On	Off	2.774699	Monday	No	75.364373
1	2022-01-01 01:00:00	27.731651	54.225919	1411.064918	1	On	On	21.831384	Saturday	No	83.401855
2	2022-01-01 02:00:00	28.704277	58.907658	1755.715009	2	Off	Off	6.764672	Sunday	No	78.270888
3	2022-01-01 03:00:00	20.080469	50.371637	1452.316318	1	Off	On	8.623447	Wednesday	No	56.519850
4	2022-01-01 04:00:00	23.097359	51.401421	1094.130359	9	On	Off	3.071969	Friday	No	70.811732

[45]:
```
import pandas as pd

df['Timestamp'] = pd.to_datetime(df['Timestamp'])
```

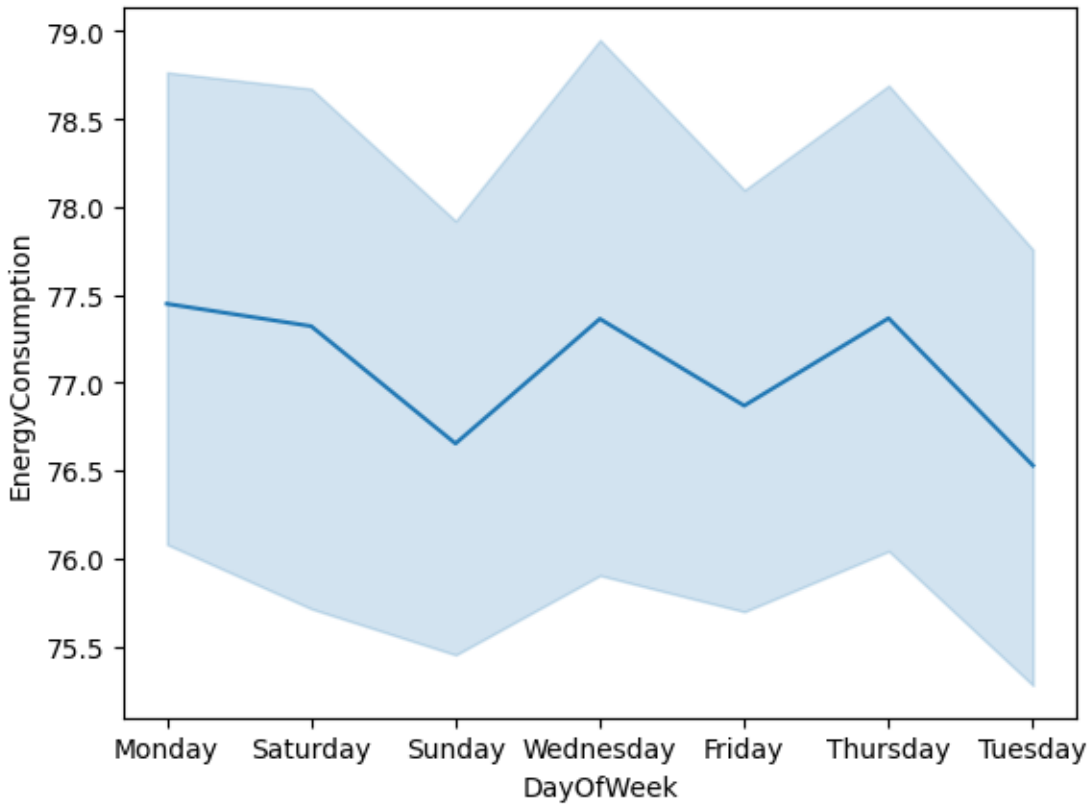
[46]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
```

```
Data columns (total 11 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Timestamp          1000 non-null   datetime64[ns]
 1   Temperature        1000 non-null   float64
 2   Humidity           1000 non-null   float64
 3   SquareFootage      1000 non-null   float64
 4   Occupancy          1000 non-null   int64
 5   HVACUsage          1000 non-null   object
 6   LightingUsage      1000 non-null   object
 7   RenewableEnergy    1000 non-null   float64
 8   DayOfWeek          1000 non-null   object
 9   Holiday            1000 non-null   object
 10  EnergyConsumption  1000 non-null   float64
dtypes: datetime64[ns](1), float64(5), int64(1), object(4)
memory usage: 86.1+ KB
```

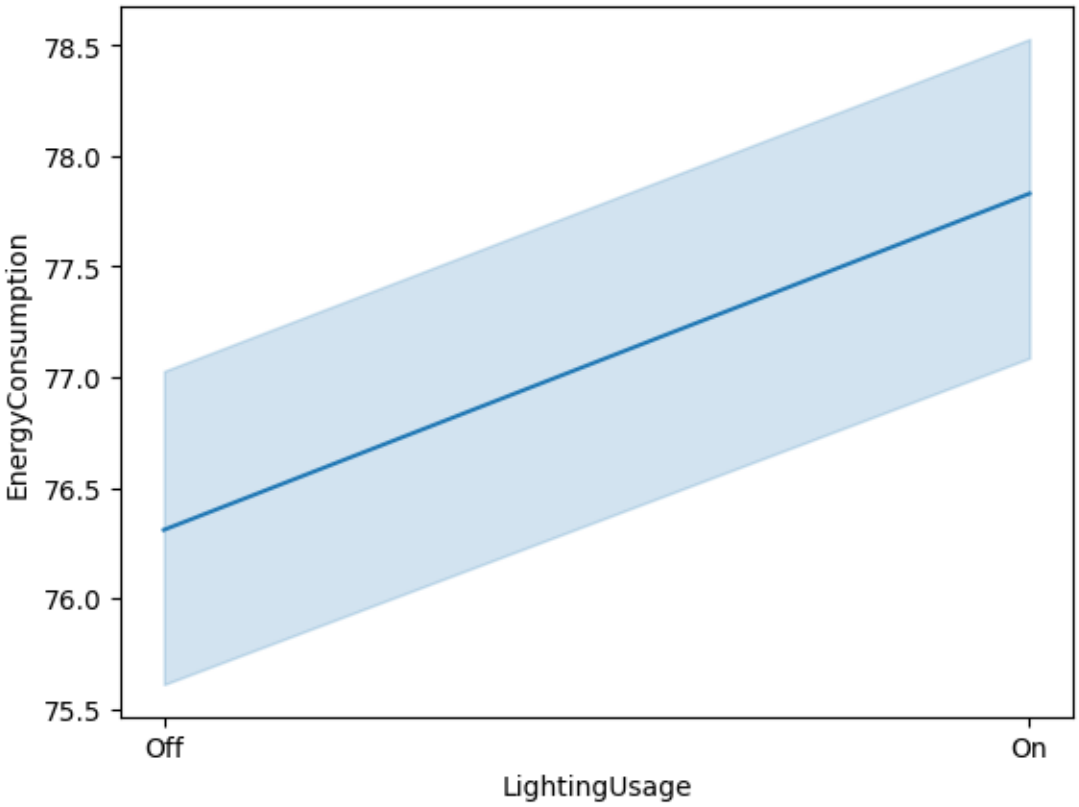
[47]:
```
sns.lineplot(x="DayOfWeek",y="EnergyConsumption",data=df)
```

[47]:
```
<Axes: xlabel='DayOfWeek', ylabel='EnergyConsumption'>
```



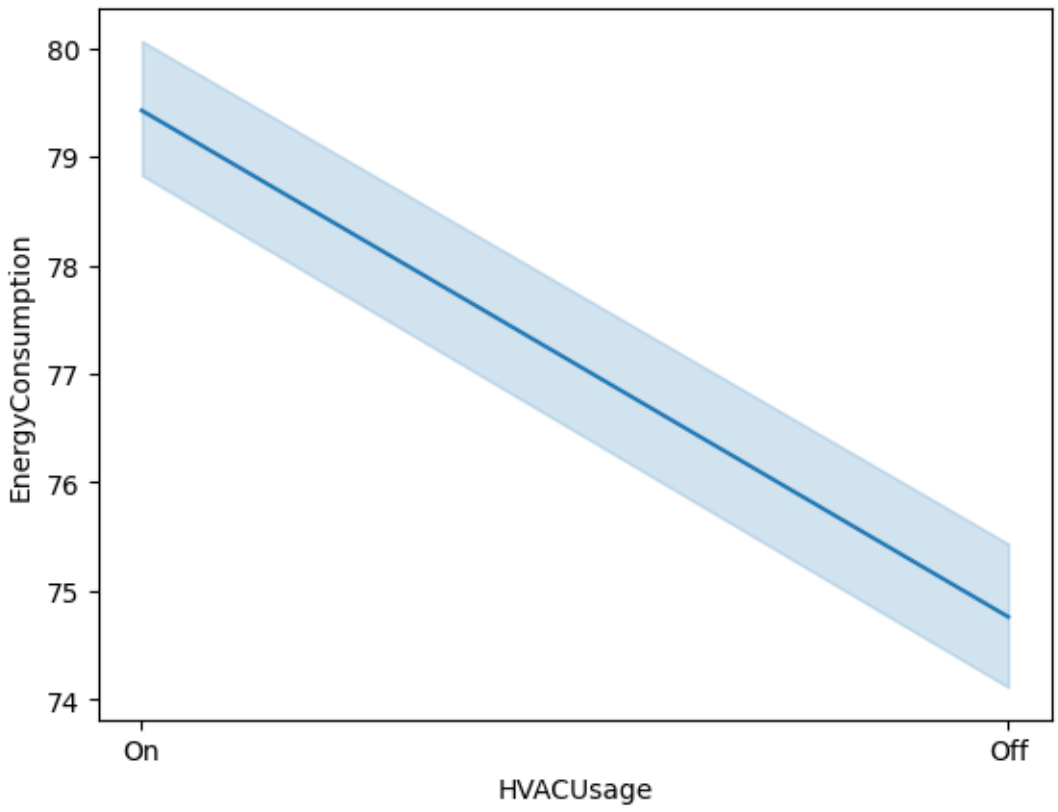
[48]:
```
sns.lineplot(y="EnergyConsumption",x="LightingUsage",data=df)
```

[48]:
```
<Axes: xlabel='LightingUsage', ylabel='EnergyConsumption'>
```



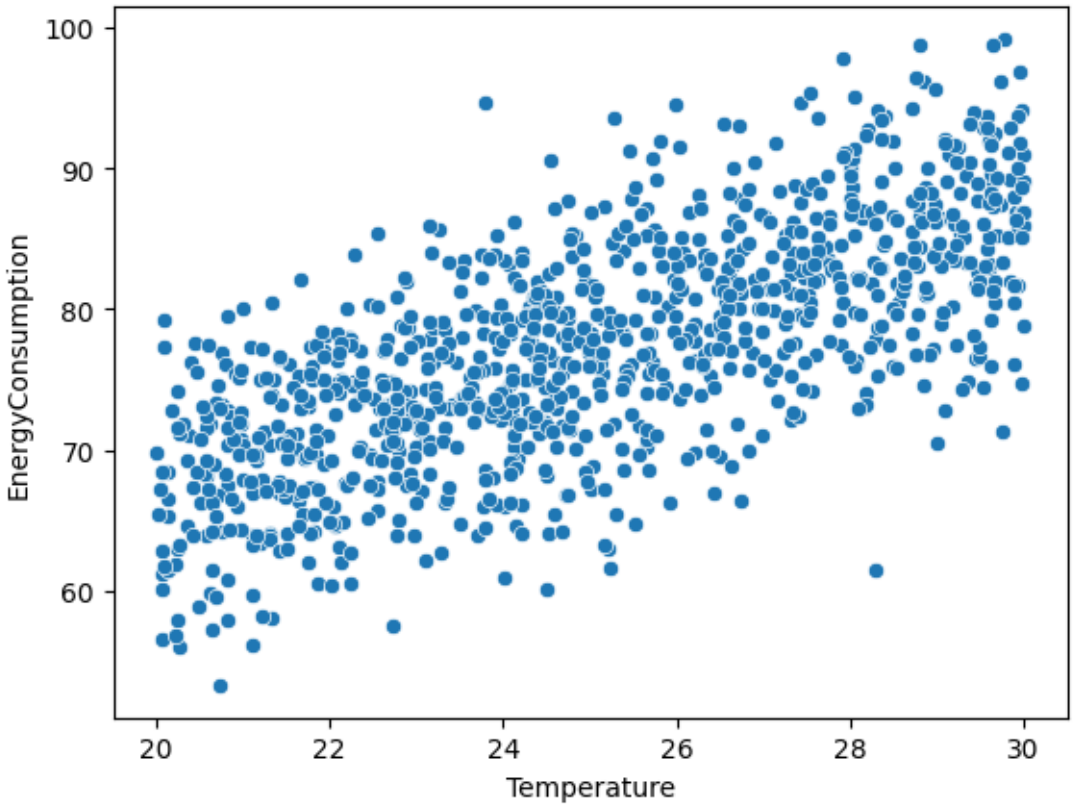
[49]:
```
sns.lineplot(y="EnergyConsumption",x="HVACUsage",data=df)
```

[49]:
```
<Axes: xlabel='HVACUsage', ylabel='EnergyConsumption'>
```



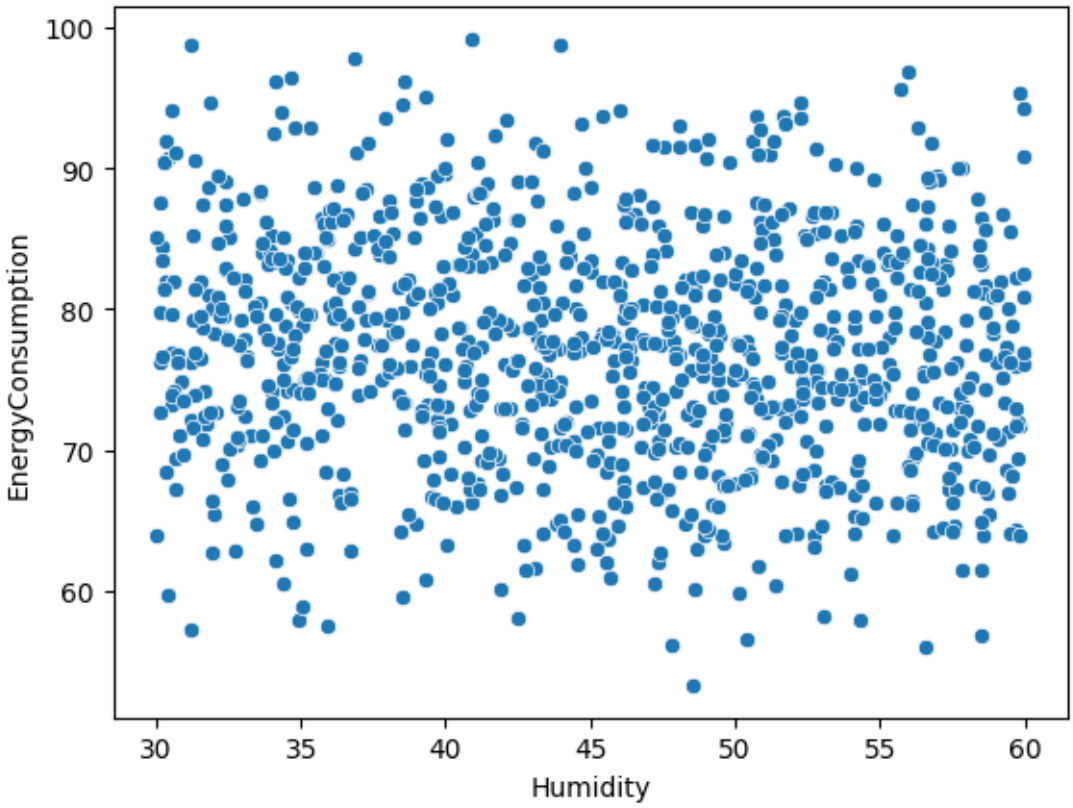
[50]:
```
sns.scatterplot(y="EnergyConsumption",x="Temperature",data=df)
```

[50]:
```
<Axes: xlabel='Temperature', ylabel='EnergyConsumption'>
```



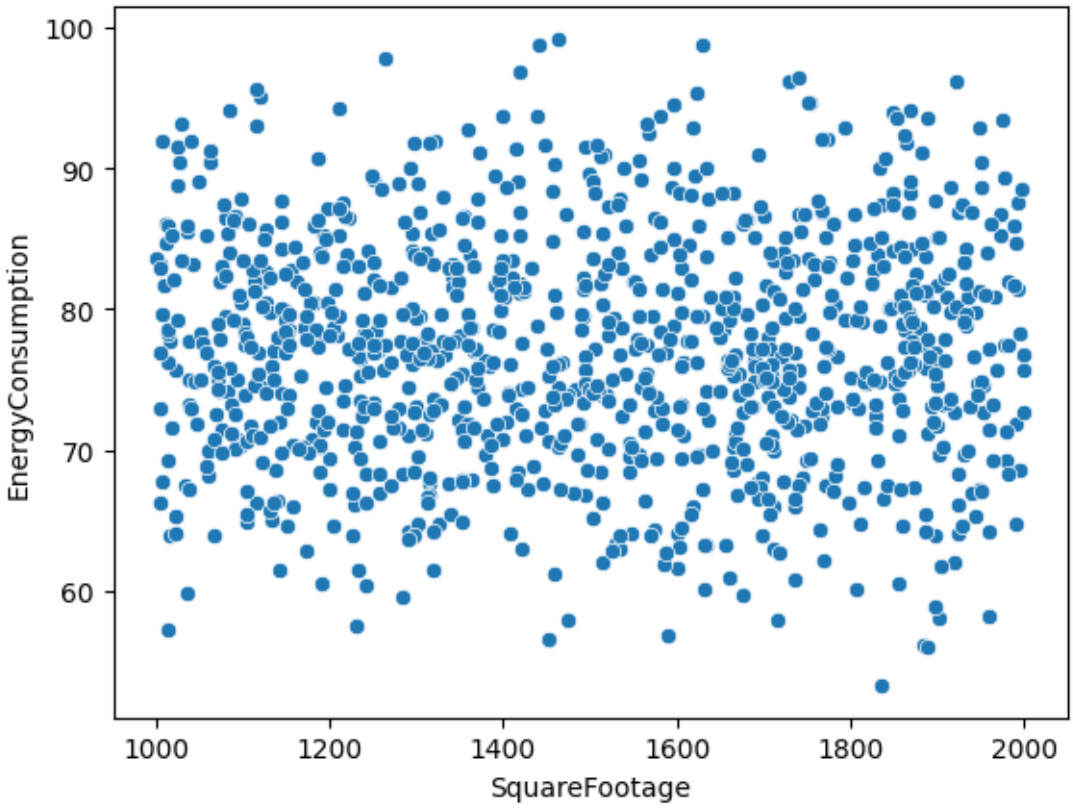
[51]:
```
sns.scatterplot(y="EnergyConsumption",x="Humidity",data=df)
```

[51]: <Axes: xlabel='Humidity', ylabel='EnergyConsumption'>



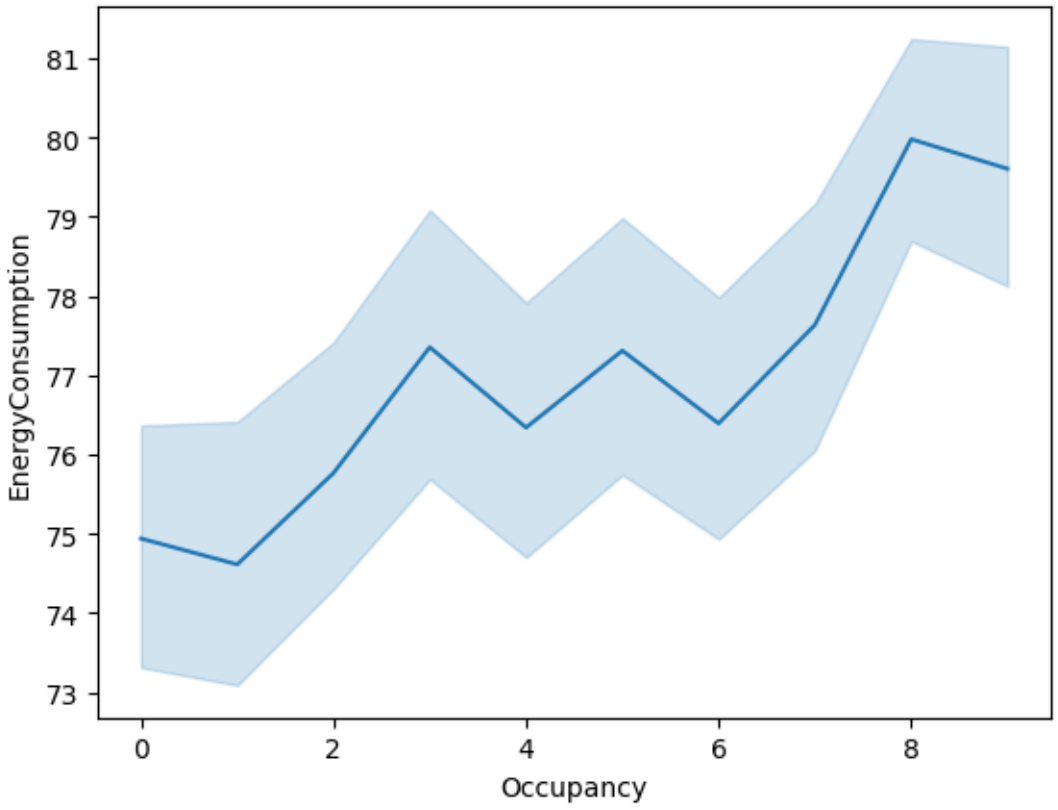
[52]:
```
sns.scatterplot(y="EnergyConsumption",x="SquareFootage",data=df)
```

[52]: <Axes: xlabel='SquareFootage', ylabel='EnergyConsumption'>



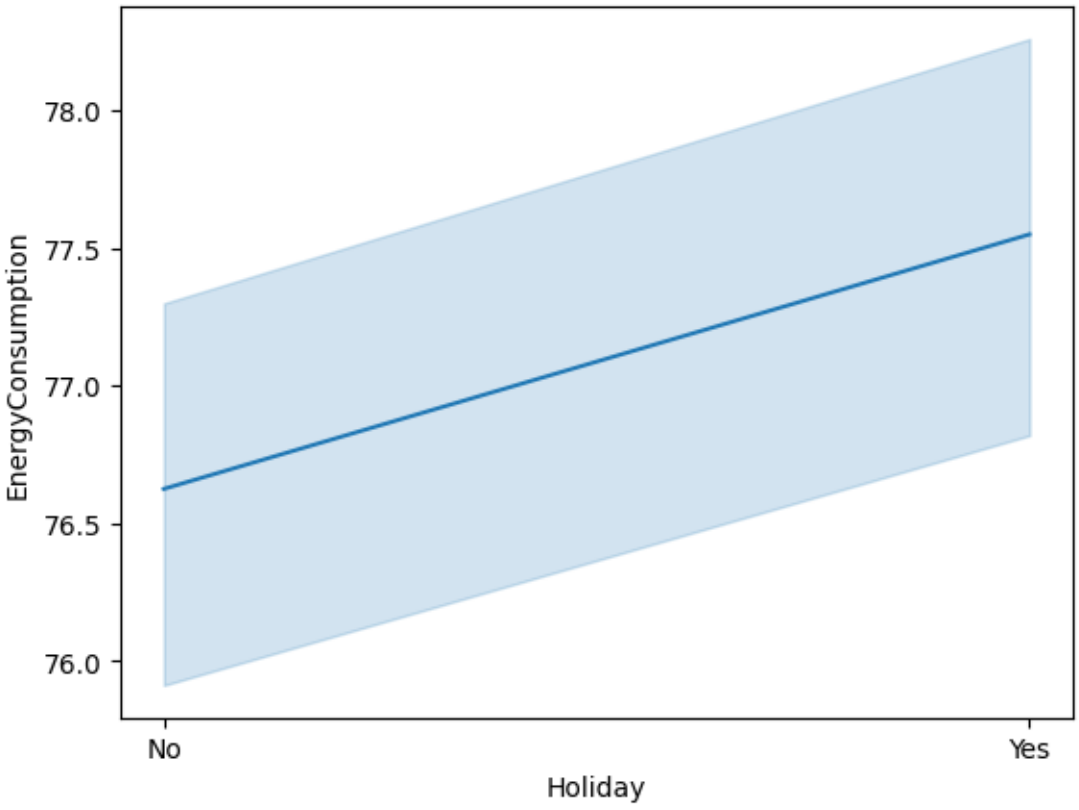
[53]:
```
sns.lineplot(y="EnergyConsumption",x="Occupancy",data=df)
```

[53]: <Axes: xlabel='Occupancy', ylabel='EnergyConsumption'>



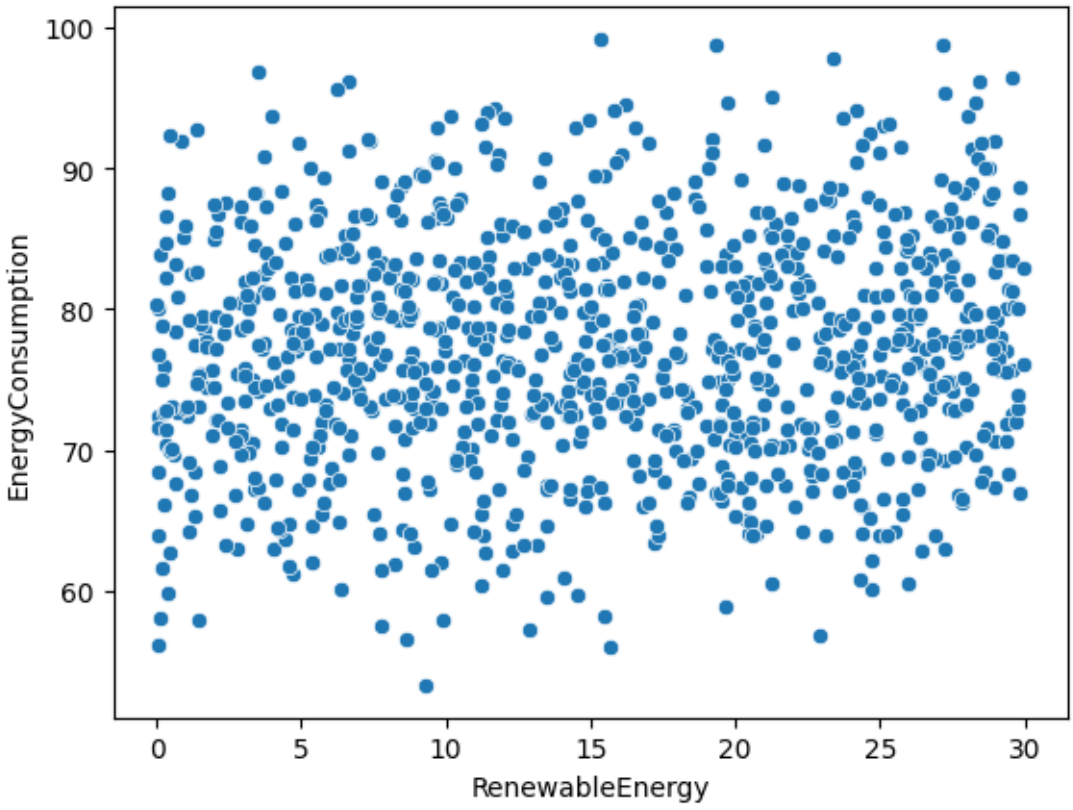
[54]:
```
sns.lineplot(x="Holiday",y="EnergyConsumption",data=df)
```

[54]:
```
<Axes: xlabel='Holiday', ylabel='EnergyConsumption'>
```



[55]:
```
sns.scatterplot(x="RenewableEnergy",y="EnergyConsumption",data=df)
```

[55]: <Axes: xlabel='RenewableEnergy', ylabel='EnergyConsumption'>



[56]:
```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
for i in ['HVACUsage','LightingUsage','Holiday',"DayOfWeek"]:
    df[i] = le.fit_transform(df[i])
```

[57]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 11 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Timestamp          1000 non-null   datetime64[ns]
 1   Temperature        1000 non-null   float64
 2   Humidity           1000 non-null   float64
 3   SquareFootage      1000 non-null   float64
 4   Occupancy          1000 non-null   int64
 5   HVACUsage          1000 non-null   int32
 6   LightingUsage      1000 non-null   int32
 7   RenewableEnergy    1000 non-null   float64
 8   DayOfWeek          1000 non-null   int32
```

```
 9   Holiday            1000 non-null   int32
 10  EnergyConsumption  1000 non-null   float64
dtypes: datetime64[ns](1), float64(5), int32(4), int64(1)
memory usage: 70.4 KB
```

[58]:
```
df.head()
```

[58]:

	Timestamp	Temperature	Humidity	SquareFootage	Occupancy	HVACUsage	LightingUsage	RenewableEnergy	DayOfWeek	Holiday	EnergyConsumption
0	2022-01-01 00:00:00	25.139433	43.431581	1565.693999	5	1	0	2.774699	1	0	75.364373
1	2022-01-01 01:00:00	27.731651	54.225919	1411.064918	1	1	1	21.831384	2	0	83.401855
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4	2022-01-01 04:00:00	23.097359	51.401421	1094.130359	9	1	0	3.071969	0	0	70.811732

[59]:
```
X = df.drop(columns=['EnergyConsumption',"Timestamp"])
y = df['EnergyConsumption']
```

[60]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, train_size=0.8,␣
 ↪random_state=42)
```

0.1 Selecting the model and choosing the parameters

[65]:
```
from sklearn.linear_model import LinearRegression

model_params = {
    'linear_regression': {
        'model': LinearRegression(),
        'params' : {
            'fit_intercept': [True, False],
            'copy_X': [True, False],
            'n_jobs': [None, 1, -1],
            'positive': [True, False]
```

```
        }
    }
}

model = LinearRegression()
```

[69]:
```
from sklearn.model_selection import GridSearchCV
scores = []



for model_name, mp in model_params.items():
    clf =  GridSearchCV(mp['model'], mp['params'], cv=5,␣
 ↪return_train_score=False)
    clf.fit(X_train,y_train)
    scores.append({
        'model': model_name,
        'best_score': clf.best_score_,
        'best_params': clf.best_params_
    })

best = pd.DataFrame(scores,columns=['model','best_score','best_params'])
best
```

[69]:
```
               model  best_score  \
0  linear_regression    0.612601

                                         best_params
0  {'copy_X': True, 'fit_intercept': True, 'n_job…
```

[75]:
```
# Fit the final model with the best parameters
best_model_params = best.loc[best['model'] == 'linear_regression',␣
 ↪'best_params'].values[0]
final_model = LinearRegression(**best_model_params)
final_model.fit(X_train, y_train)
```

[75]:
```
LinearRegression(positive=True)
```

[78]:
```
y_pred = final_model.predict(X_test)
```

[79]:
```
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
import numpy as np


mae = mean_absolute_error(y_test, y_pred)
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
```

```
r2 = r2_score(y_test, y_pred)

print("Mean Absolute Error:", mae)
print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("R² Score:", r2)
```

```
Mean Absolute Error: 4.105494668584672
Mean Squared Error: 26.478930032168474
Root Mean Squared Error: 5.145768167355431
R² Score: 0.5957407580531275
```