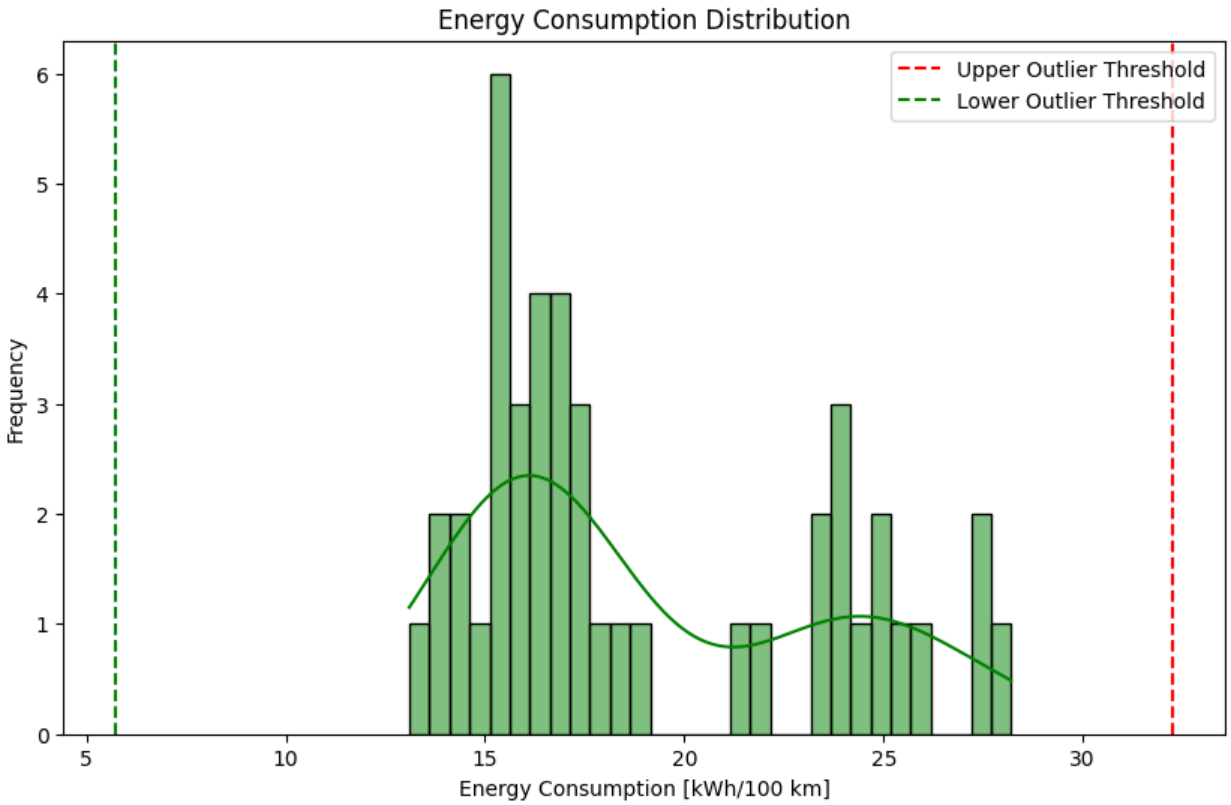
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from scipy import stats
from scipy.stats import ttest_ind
import os

a_df = pd.read_excel(r"C:\Users\jeeve\Desktop\PGC\Course 5 Python\
Project\FEV-data-Excel.xlsx")

#TASK 1
filtered_df = a_df[(a_df['Minimal price (gross) [PLN]'] <= 350000) &
(a_df['Range (WLTP) [km]'] >= 400)]
avg_battery = filtered_df.groupby('Make')['Battery capacity
[kWh]'].mean().reset_index()
print("Filtered EVs:")
print(filtered_df[['Car full name', 'Make', 'Minimal price (gross)
[PLN]', 'Range (WLTP) [km]']])
print("\nAverage Battery Capacity by Manufacturer:")
print(avg_battery)
```

```
Filtered EVs:
                        Car full name           Make  \
0              Audi e-tron 55 quattro           Audi
8                           BMW iX3            BMW
15        Hyundai Kona electric 64kWh        Hyundai
18                  Kia e-Niro 64kWh            Kia
20                  Kia e-Soul 64kWh            Kia
22                 Mercedes-Benz EQC  Mercedes-Benz
39  Tesla Model 3 Standard Range Plus          Tesla
40           Tesla Model 3 Long Range          Tesla
41         Tesla Model 3 Performance           Tesla
47    Volkswagen ID.3 Pro Performance     Volkswagen
48             Volkswagen ID.3 Pro S     Volkswagen
49               Volkswagen ID.4 1st     Volkswagen

    Minimal price (gross) [PLN]  Range (WLTP) [km]
0                        345700                438
8                        282900                460
15                       178400                449
18                       167990                455
20                       160990                452
22                       334700                414
39                       195490                430
40                       235490                580
41                       260490                567
47                       155890                425
48                       179990                549
49                       202390                500
```

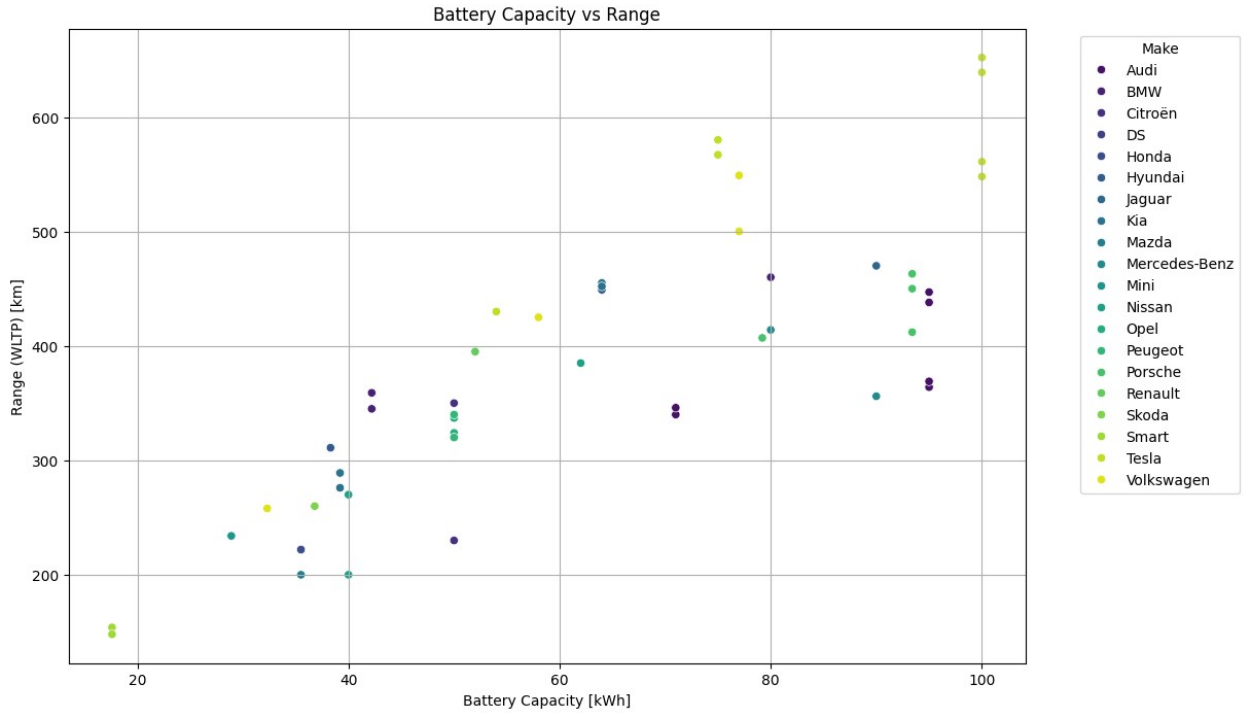
```
Average Battery Capacity by Manufacturer:
            Make  Battery capacity [kWh]
0           Audi                95.000000
1            BMW                80.000000
2        Hyundai                64.000000
3            Kia                64.000000
4  Mercedes-Benz                80.000000
5          Tesla                68.000000
6     Volkswagen                70.666667
```

```python
# Task 2: Identify Outliers in Energy Consumption (Z-Score Method Fixed)
energy_consumption_column = [col for col in a_df.columns if 'energy consumption' in col.lower()][0]
energy_consumption = a_df[energy_consumption_column].dropna()
# Calculate Z-Scores
z_scores = (energy_consumption - energy_consumption.mean()) / energy_consumption.std()
# Reset index to align DataFrame and Z-score series
energy_consumption = energy_consumption.reset_index(drop=True)
z_scores = z_scores.reset_index(drop=True)
# Defining Outliers
outliers = a_df.loc[z_scores[np.abs(z_scores) > 3].index]
# Plot the Distribution with Z-Score Threshold
plt.figure(figsize=(10, 6))
sns.histplot(energy_consumption, bins=30, kde=True, color='green')
plt.title('Energy Consumption Distribution')
plt.xlabel('Energy Consumption [kWh/100 km]')
plt.ylabel('Frequency')
plt.axvline(energy_consumption.mean() + 3 * energy_consumption.std(), color='red', linestyle='dashed', label='Upper Outlier Threshold')
plt.axvline(energy_consumption.mean() - 3 * energy_consumption.std(), color='green', linestyle='dashed', label='Lower Outlier Threshold')
plt.legend()
plt.show()
# Display Outliers
print("Outliers in Energy Consumption:")
print(outliers[['Make', 'Model', energy_consumption_column]])
```




```
Outliers in Energy Consumption:
Empty DataFrame
Columns: [Make, Model, mean - Energy consumption [kWh/100 km]]
Index: []

#TASK 3
plt.figure(figsize=(12, 8))
sns.scatterplot(x='Battery capacity [kWh]', y='Range (WLTP) [km]',
data=a_df, hue='Make', palette='viridis')
plt.title('Battery Capacity vs Range')
plt.xlabel('Battery Capacity [kWh]')
plt.ylabel('Range (WLTP) [km]')
plt.legend(title='Make', bbox_to_anchor=(1.05, 1), loc='upper left')
plt.grid(True)
plt.show()
correlation = a_df[['Battery capacity [kWh]', 'Range (WLTP)
[km]']].corr().iloc[0, 1]
print(f"Correlation between Battery Capacity and Range:
{correlation:.2f}")
if correlation > 0.7:
    print("There is a strong positive relationship between Battery
Capacity and Range.")
elif correlation > 0.4:
    print("There is a moderate positive relationship between Battery
Capacity and Range.")
```

```
else:
    print("There is a weak or no significant relationship between
Battery Capacity and Range.")
```




```
Correlation between Battery Capacity and Range: 0.81
There is a strong positive relationship between Battery Capacity and
Range.

#TASK 4
def recommend_ev():
    budget = int(input("Enter your Budget (PLN): "))
    range_km = int(input("Enter Minimum Range (km): "))
    battery_capacity = float(input("Enter Minimum Battery Capacity
(kWh): "))
    filtered = a_df[(a_df['Minimal price (gross) [PLN]'] <= budget) &
                (a_df['Range (WLTP) [km]'] >= range_km) &
                (a_df['Battery capacity [kWh]'] >= battery_capacity)]
    top_ev = filtered[['Car full name', 'Minimal price (gross) [PLN]',
'Range (WLTP) [km]', 'Battery capacity [kWh]']].head(3)
    if top_ev.empty:
        print("\nNo EVs Found Matching Your Criteria!")
    else:
        print("\nTop 3 Recommended EVs:")
        print(top_ev)
recommend_ev()
```

```
Top 3 Recommended EVs:
                  Car full name  Minimal price (gross) [PLN]  \
0        Audi e-tron 55 quattro                       345700
8                       BMW iX3                       282900
15  Hyundai Kona electric 64kWh                       178400

    Range (WLTP) [km]  Battery capacity [kWh]
0                 438                   95.0
8                 460                   80.0
15                449                   64.0
```

```
#TASK5
tesla = a_df[a_df['Make'] == 'Tesla']['Engine power [KM]']
audi = a_df[a_df['Make'] == 'Audi']['Engine power [KM]']
t_stat, p_value = ttest_ind(tesla, audi)
print("Tesla Engine Power Average:", tesla.mean())
print("Audi Engine Power Average:", audi.mean())
print("T-Statistic:", t_stat)
print("P-Value:", p_value)
if p_value < 0.05:
    print("\n Significant Difference between Tesla and Audi Engine
Power")
else:
    print("\n!! No Significant Difference between Tesla and Audi
Engine Power")
```

```
Tesla Engine Power Average: 533.0
Audi Engine Power Average: 392.0
T-Statistic: 1.7024444538261416
P-Value: 0.11672692675082785

!! No Significant Difference between Tesla and Audi Engine Power
```

```
video_link =
"https://drive.google.com/file/d/17w8VIzo1f1p7if873wF8447eVlbR16lF/
view?usp=sharing"
with open("VideoLink.txt", "w") as file:
    file.write(f"Project Video Explanation Link: {video_link}")
print("Video link saved successfully.")
print(f"Video Explanation Link: {video_link}")
if os.path.exists("VideoLink.txt"):
    print("File created successfully")
else:
    print("Error")
```

```
Video link saved successfully.
Video Explanation Link:
https://drive.google.com/file/d/17w8VIzo1f1p7if873wF8447eVlbR16lF/
```

```
view?usp=sharing
File created successfully
```