Electric Vehicle Data Analysis Project

In [1]:
```
import pandas as pd
import numpy as np
ev_def= pd.read_excel("FEV-data-Excel.xlsx")
print(ev_def)
```

Please scroll down till
9th page to see my task performed

Here I imported the data
by using pandas library

```
                          Car full name          Make  \
0                 Audi e-tron 55 quattro          Audi
1                 Audi e-tron 50 quattro          Audi
2                  Audi e-tron S quattro          Audi
3       Audi e-tron Sportback 50 quattro          Audi
4       Audi e-tron Sportback 55 quattro          Audi
5        Audi e-tron Sportback S quattro          Audi
6                                BMW i3           BMW
7                               BMW i3s           BMW
8                               BMW iX3           BMW
9                          Citroën ë-C4       Citroën
10             DS DS3 Crossback e-tense            DS
11                              Honda e         Honda
12                      Honda e Advance         Honda
13                Hyundai Ioniq electric       Hyundai
14         Hyundai Kona electric 39.2kWh       Hyundai
15           Hyundai Kona electric 64kWh       Hyundai
16                         Jaguar I-Pace        Jaguar
17                     Kia e-Niro 39.2kWh          Kia
18                       Kia e-Niro 64kWh          Kia
19                     Kia e-Soul 39.2kWh          Kia
20                       Kia e-Soul 64kWh          Kia
21                          Mazda MX-30         Mazda
22                    Mercedes-Benz EQC  Mercedes-Benz
23                       Mini Cooper SE          Mini
24                          Nissan Leaf        Nissan
25                       Nissan Leaf e+        Nissan
26                        Opel Corsa-e          Opel
27                        Opel Mokka-e          Opel
28                       Peugeot e-208       Peugeot
29                      Peugeot e-2008       Peugeot
30       Porsche Taycan 4S (Performance)       Porsche
31  Porsche Taycan 4S (Performance Plus)       Porsche
32                 Porsche Taycan Turbo       Porsche
33               Porsche Taycan Turbo S       Porsche
34                     Renault Zoe R110       Renault
35                     Renault Zoe R135       Renault
36                   Skoda Citigo-e iV         Skoda
37                     Smart fortwo EQ         Smart
38                    Smart forfour EQ         Smart
39     Tesla Model 3 Standard Range Plus         Tesla
40              Tesla Model 3 Long Range         Tesla
41             Tesla Model 3 Performance         Tesla
42         Tesla Model S Long Range Plus         Tesla
43             Tesla Model S Performance         Tesla
44         Tesla Model X Long Range Plus         Tesla
45             Tesla Model X Performance         Tesla
46                    Volkswagen e-up!    Volkswagen
47       Volkswagen ID.3 Pro Performance    Volkswagen
48                Volkswagen ID.3 Pro S    Volkswagen
49                  Volkswagen ID.4 1st    Volkswagen
50            Citroën ë-Spacetourer (M)       Citroën
51             Mercedes-Benz EQV (long)  Mercedes-Benz
52                Nissan e-NV200 evalia        Nissan

                          Model  Minimal price (gross) [PLN]  \
0             e-tron 55 quattro                       345700
1             e-tron 50 quattro                       308400
2              e-tron S quattro                       414900
3    e-tron Sportback 50 quattro                       319700
```

4	e-tron Sportback 55 quattro	357000
5	e-tron Sportback S quattro	426200
6	i3	169700
7	i3s	184200
8	iX3	282900
9	ë-C4	125000
10	DS3 Crossback e-tense	159900
11	e	152900
12	e Advance	165900
13	Ioniq electric	184500
14	Kona electric 39.2kWh	154400
15	Kona electric 64kWh	178400
16	I-Pace	359500
17	e-Niro 39.2kWh	146990
18	e-Niro 64kWh	167990
19	e-Soul 39.2kWh	139900
20	e-Soul 64kWh	160990
21	MX-30	142900
22	EQC	334700
23	Cooper SE	139900
24	Leaf	122900
25	Leaf e+	164000
26	Corsa-e	128900
27	Mokka-e	139900
28	e-208	124900
29	e-2008	149400
30	Taycan 4S (Performance)	457000
31	Taycan 4S (Performance Plus)	482283
32	Taycan Turbo	653000
33	Taycan Turbo S	794000
34	Zoe R110	135900
35	Zoe R135	142900
36	Citigo-e iV	82050
37	fortwo EQ	96900
38	forfour EQ	98900
39	Model 3 Standard Range Plus	195490
40	Model 3 Long Range	235490
41	Model 3 Performance	260490
42	Model S Long Range Plus	368990
43	Model S Performance	443990
44	Model X Long Range Plus	407990
45	Model X Performance	482990
46	e-up!	97990
47	ID.3 Pro Performance	155890
48	ID.3 Pro S	179990
49	ID.4 1st	202390
50	ë-Spacetourer (M)	215400
51	EQV (long)	339480
52	e-NV200 evalia	164328

	Engine power [KM]	Maximum torque [Nm]	Type of brakes \
0	360	664	disc (front + rear)
1	313	540	disc (front + rear)
2	503	973	disc (front + rear)
3	313	540	disc (front + rear)
4	360	664	disc (front + rear)
5	503	973	disc (front + rear)
6	170	250	disc (front + rear)
7	184	270	disc (front + rear)
8	286	400	disc (front + rear)

```
9                   136                  260         disc (front + rear)
10                  136                  260         disc (front + rear)
11                  136                  315         disc (front + rear)
12                  154                  315         disc (front + rear)
13                  136                  295         disc (front + rear)
14                  136                  395         disc (front + rear)
15                  204                  395         disc (front + rear)
16                  400                  696         disc (front + rear)
17                  136                  395         disc (front + rear)
18                  204                  395         disc (front + rear)
19                  136                  395         disc (front + rear)
20                  204                  395         disc (front + rear)
21                  145                  270         disc (front + rear)
22                  408                  760         disc (front + rear)
23                  184                  270         disc (front + rear)
24                  150                  320         disc (front + rear)
25                  217                  340         disc (front + rear)
26                  136                  260         disc (front + rear)
27                  136                  260         disc (front + rear)
28                  136                  260         disc (front + rear)
29                  136                  260         disc (front + rear)
30                  435                  640         disc (front + rear)
31                  490                  650         disc (front + rear)
32                  625                  850         disc (front + rear)
33                  625                 1050         disc (front + rear)
34                  108                  225         disc (front + rear)
35                  135                  245         disc (front + rear)
36                   83                  212  disc (front) + drum (rear)
37                   82                  160  disc (front) + drum (rear)
38                   82                  160  disc (front) + drum (rear)
39                  285                  450         disc (front + rear)
40                  372                  510         disc (front + rear)
41                  480                  639         disc (front + rear)
42                  525                  755         disc (front + rear)
43                  772                 1140         disc (front + rear)
44                  525                  755         disc (front + rear)
45                  772                 1140         disc (front + rear)
46                   83                  210  disc (front) + drum (rear)
47                  204                  310  disc (front) + drum (rear)
48                  204                  310  disc (front) + drum (rear)
49                  204                  310  disc (front) + drum (rear)
50                  136                  260         disc (front + rear)
51                  204                  362                         NaN
52                  109                  254         disc (front + rear)

     Drive type  Battery capacity [kWh]  Range (WLTP) [km]  ...  \
0           4WD                    95.0                438  ...
1           4WD                    71.0                340  ...
2           4WD                    95.0                364  ...
3           4WD                    71.0                346  ...
4           4WD                    95.0                447  ...
5           4WD                    95.0                369  ...
6    2WD (rear)                    42.2                359  ...
7    2WD (rear)                    42.2                345  ...
8    2WD (rear)                    80.0                460  ...
9   2WD (front)                    50.0                350  ...
10  2WD (front)                    50.0                320  ...
11   2WD (rear)                    35.5                222  ...
12   2WD (rear)                    35.5                222  ...
13  2WD (front)                    38.3                311  ...
```

```
14  2WD (front)                           39.2                 289  ...
15  2WD (front)                           64.0                 449  ...
16          4WD                           90.0                 470  ...
17  2WD (front)                           39.2                 289  ...
18  2WD (front)                           64.0                 455  ...
19  2WD (front)                           39.2                 276  ...
20  2WD (front)                           64.0                 452  ...
21  2WD (front)                           35.5                 200  ...
22          4WD                           80.0                 414  ...
23  2WD (front)                           28.9                 234  ...
24  2WD (front)                           40.0                 270  ...
25  2WD (front)                           62.0                 385  ...
26  2WD (front)                           50.0                 337  ...
27  2WD (front)                           50.0                 324  ...
28  2WD (front)                           50.0                 340  ...
29  2WD (front)                           50.0                 320  ...
30          4WD                           79.2                 407  ...
31          4WD                           93.4                 463  ...
32          4WD                           93.4                 450  ...
33          4WD                           93.4                 412  ...
34  2WD (front)                           52.0                 395  ...
35  2WD (front)                           52.0                 395  ...
36  2WD (front)                           36.8                 260  ...
37   2WD (rear)                           17.6                 154  ...
38   2WD (rear)                           17.6                 148  ...
39   2WD (rear)                           54.0                 430  ...
40          4WD                           75.0                 580  ...
41          4WD                           75.0                 567  ...
42          4WD                          100.0                 652  ...
43          4WD                          100.0                 639  ...
44          4WD                          100.0                 561  ...
45          4WD                          100.0                 548  ...
46  2WD (front)                           32.3                 258  ...
47   2WD (rear)                           58.0                 425  ...
48   2WD (rear)                           77.0                 549  ...
49   2WD (rear)                           77.0                 500  ...
50  2WD (front)                           50.0                 230  ...
51  2WD (front)                           90.0                 356  ...
52  2WD (front)                           40.0                 200  ...

    Permissable gross weight [kg]  Maximum load capacity [kg]  \
0                          3130.0                       640.0
1                          3040.0                       670.0
2                          3130.0                       565.0
3                          3040.0                       640.0
4                          3130.0                       670.0
5                          3130.0                       565.0
6                          1730.0                       440.0
7                          1730.0                       440.0
8                          2725.0                       540.0
9                          2000.0                       459.0
10                         1975.0                       450.0
11                         1855.0                       342.0
12                         1870.0                       350.0
13                         1970.0                       518.0
14                         2020.0                       485.0
15                         2170.0                       485.0
16                         2670.0                       537.0
17                         2080.0                       488.0
18                         2230.0                       493.0
```

19	1682.0	490.0
20	1682.0	498.0
21	2119.0	474.0
22	2940.0	445.0
23	1770.0	480.0
24	1995.0	450.0
25	2140.0	435.0
26	1916.0	367.0
27	2015.0	417.0
28	1918.0	463.0
29	NaN	NaN
30	2880.0	740.0
31	2880.0	660.0
32	2880.0	575.0
33	2870.0	575.0
34	1988.0	425.0
35	1988.0	486.0
36	1530.0	367.0
37	1310.0	290.0
38	1570.0	445.0
39	NaN	NaN
40	NaN	NaN
41	NaN	NaN
42	NaN	NaN
43	NaN	NaN
44	NaN	NaN
45	NaN	NaN
46	1530.0	370.0
47	2270.0	540.0
48	2280.0	412.0
49	2660.0	661.0
50	2810.0	1056.0
51	3500.0	865.0
52	2250.0	658.0

	Number of seats	Number of doors	Tire size [in]	Maximum speed [kph] \
0	5	5	19	200
1	5	5	19	190
2	5	5	20	210
3	5	5	19	190
4	5	5	19	200
5	5	5	20	210
6	4	5	19	160
7	4	5	20	160
8	5	5	19	180
9	5	5	16	150
10	5	5	17	150
11	5	5	16	145
12	5	5	17	145
13	5	5	16	165
14	5	5	17	155
15	5	5	17	167
16	5	5	20	200
17	5	5	17	155
18	5	5	17	167
19	5	5	17	157
20	5	5	17	167
21	5	5	18	140
22	5	5	19	180
23	4	3	16	150

24	5	5	16	144
25	5	5	17	157
26	5	5	16	150
27	5	5	16	150
28	5	5	16	150
29	5	5	16	150
30	4	4	19	250
31	4	4	19	250
32	4	4	20	260
33	4	4	21	260
34	5	5	15	135
35	5	5	16	140
36	4	5	14	130
37	2	3	15	130
38	4	5	15	130
39	5	5	18	225
40	5	5	18	233
41	5	5	20	261
42	5	5	19	250
43	5	5	21	261
44	7	5	20	250
45	7	5	20	261
46	4	5	14	130
47	5	5	18	160
48	5	5	19	160
49	5	5	20	160
50	8	5	16	130
51	6	5	17	160
52	5	5	15	123

	Boot capacity (VDA) [l]	Acceleration 0-100 kph [s]	\
0	660.0	5.7	
1	660.0	6.8	
2	660.0	4.5	
3	615.0	6.8	
4	615.0	5.7	
5	615.0	4.5	
6	260.0	8.1	
7	260.0	6.9	
8	510.0	6.8	
9	380.0	9.5	
10	350.0	8.7	
11	171.0	9.0	
12	171.0	8.3	
13	357.0	9.9	
14	332.0	9.7	
15	332.0	7.6	
16	656.0	4.8	
17	451.0	9.8	
18	451.0	7.8	
19	315.0	9.9	
20	315.0	7.9	
21	350.0	9.7	
22	500.0	5.1	
23	211.0	7.3	
24	435.0	7.9	
25	435.0	6.9	
26	267.0	8.1	
27	310.0	9.0	
28	311.0	8.1	

29	434.0	NaN
30	488.0	4.0
31	488.0	4.0
32	447.0	3.2
33	447.0	2.8
34	338.0	11.4
35	338.0	9.5
36	250.0	12.3
37	185.0	11.6
38	260.0	12.7
39	425.0	5.6
40	425.0	4.4
41	425.0	3.3
42	745.0	3.8
43	745.0	2.5
44	857.0	4.6
45	857.0	2.8
46	250.0	11.9
47	385.0	7.3
48	385.0	7.9
49	543.0	8.5
50	603.0	13.1
51	NaN	NaN
52	870.0	NaN

	Maximum DC charging power [kW]	mean - Energy consumption [kWh/100 km]
0	150	24.45
1	150	23.80
2	150	27.55
3	150	23.30
4	150	23.85
5	150	27.20
6	50	13.10
7	50	14.30
8	150	18.80
9	100	NaN
10	100	15.60
11	100	17.20
12	100	17.50
13	100	13.80
14	100	15.00
15	100	15.40
16	100	21.20
17	100	15.30
18	100	15.90
19	100	15.60
20	100	15.70
21	37	14.50
22	110	21.85
23	50	16.75
24	50	18.50
25	100	17.10
26	100	16.65
27	100	17.60
28	100	16.40
29	100	NaN
30	225	23.40
31	270	24.10
32	270	24.85
33	270	25.10

34	50	16.50
35	50	16.50
36	40	15.45
37	22	16.35
38	22	17.00
39	150	NaN
40	150	NaN
41	150	NaN
42	150	NaN
43	150	NaN
44	150	NaN
45	150	NaN
46	40	14.00
47	100	15.40
48	125	15.90
49	125	18.00
50	100	25.20
51	110	28.20
52	50	25.90

[53 rows x 25 columns]

TASK=1

In [17]:

```
# Step 1: Filter rows where a range of EVs <= 400
filtered_evs = ev_def[ev_def["Range (WLTP) [km]"] <= 400]
# Step 2: Select specific columns
selected_columns = filtered_evs[["Car full name", "Make", "Model", "Range (WLTP)
# Print result
print(selected_columns)
```

	Car full name	Make
1	Audi e-tron 50 quattro	Audi
2	Audi e-tron S quattro	Audi
3	Audi e-tron Sportback 50 quattro	Audi
5	Audi e-tron Sportback S quattro	Audi
6	BMW i3	BMW
7	BMW i3s	BMW
9	Citroën ë-C4	Citroën
10	DS DS3 Crossback e-tense	DS
11	Honda e	Honda
12	Honda e Advance	Honda
13	Hyundai Ioniq electric	Hyundai
14	Hyundai Kona electric 39.2kWh	Hyundai
17	Kia e-Niro 39.2kWh	Kia
19	Kia e-Soul 39.2kWh	Kia
21	Mazda MX-30	Mazda
23	Mini Cooper SE	Mini
24	Nissan Leaf	Nissan
25	Nissan Leaf e+	Nissan
26	Opel Corsa-e	Opel
27	Opel Mokka-e	Opel
28	Peugeot e-208	Peugeot
29	Peugeot e-2008	Peugeot
34	Renault Zoe R110	Renault
35	Renault Zoe R135	Renault
36	Skoda Citigo-e iV	Skoda
37	Smart fortwo EQ	Smart
38	Smart forfour EQ	Smart
46	Volkswagen e-up!	Volkswagen
50	Citroën ë-Spacetourer (M)	Citroën
51	Mercedes-Benz EQV (long)	Mercedes-Benz
52	Nissan e-NV200 evalia	Nissan

\

	Model	Range (WLTP) [km]	Battery capacity [kWh]
1	e-tron 50 quattro	340	71.0
2	e-tron S quattro	364	95.0
3	e-tron Sportback 50 quattro	346	71.0
5	e-tron Sportback S quattro	369	95.0
6	i3	359	42.2
7	i3s	345	42.2
9	ë-C4	350	50.0
10	DS3 Crossback e-tense	320	50.0
11	e	222	35.5
12	e Advance	222	35.5
13	Ioniq electric	311	38.3
14	Kona electric 39.2kWh	289	39.2
17	e-Niro 39.2kWh	289	39.2
19	e-Soul 39.2kWh	276	39.2
21	MX-30	200	35.5
23	Cooper SE	234	28.9
24	Leaf	270	40.0
25	Leaf e+	385	62.0
26	Corsa-e	337	50.0
27	Mokka-e	324	50.0
28	e-208	340	50.0
29	e-2008	320	50.0
34	Zoe R110	395	52.0
35	Zoe R135	395	52.0
36	Citigo-e iV	260	36.8
37	fortwo EQ	154	17.6

38	forfour EQ	148	17.6
46	e-up!	258	32.3
50	ë-Spacetourer (M)	230	50.0
51	EQV (long)	356	90.0
52	e-NV200 evalia	200	40.0

In [37]:
```
# Step 1: Filter by range and price
filtered_evs = ev_def[
    (ev_def["Range (WLTP) [km]"] <= 400) &
    (ev_def["Minimal price (gross) [PLN]"] <= 350000)]
# Step 2: Select relevant columns needed
selected_columns = filtered_evs[[
    "Car full name",
    "Make",
    "Model",
    "Range (WLTP) [km]",
    "Battery capacity [kWh]",
    "Minimal price (gross) [PLN]"]]

# Step 3: Group by makers
grouped = selected_columns.groupby("Make")

# Step 4: Printing style
for make, group in grouped:
    print(f"\n{'='*30}\n{make}\n{'='*30}")
    print(group.to_string(index=False))
## a maximum budget of 350,000 PLN and a minimum electric range of 400 km (WLTP)
#maker: Mercedes-Benz, Equipped with a 90 kWh battery
#Price: Approximately 339,480 PLN
#Range: 400 km or more (based on WLTP standards)
#This positions Mercedes-Benz as a strong contender in the premium EV segment, o
```

```
==============================
Audi
==============================
                   Car full name Make                       Model  Range (WLTP)
[km]  Battery capacity [kWh]  Minimal price (gross) [PLN]
          Audi e-tron 50 quattro Audi           e-tron 50 quattro
340                    71.0                          308400
Audi e-tron Sportback 50 quattro Audi e-tron Sportback 50 quattro
346                    71.0                          319700

==============================
BMW
==============================
Car full name Make Model  Range (WLTP) [km]  Battery capacity [kWh]  Minimal pric
e (gross) [PLN]
       BMW i3  BMW    i3                359                    42.2
169700
      BMW i3s  BMW   i3s                345                    42.2
184200

==============================
Citroën
==============================
             Car full name    Make             Model  Range (WLTP) [km]  Battery c
apacity [kWh]  Minimal price (gross) [PLN]
              Citroën ë-C4 Citroën              ë-C4                350
50.0                       125000
Citroën ë-Spacetourer (M) Citroën ë-Spacetourer (M)                230
50.0                       215400

==============================
DS
==============================
            Car full name Make                 Model  Range (WLTP) [km]  Battery c
apacity [kWh]  Minimal price (gross) [PLN]
DS DS3 Crossback e-tense   DS DS3 Crossback e-tense                320
50.0                       159900

==============================
Honda
==============================
  Car full name  Make     Model  Range (WLTP) [km]  Battery capacity [kWh]  Minim
al price (gross) [PLN]
        Honda e Honda         e                222                    35.5
152900
Honda e Advance Honda e Advance                222                    35.5
165900

==============================
Hyundai
==============================
                Car full name    Make                 Model  Range (WLTP) [km]  B
attery capacity [kWh]  Minimal price (gross) [PLN]
       Hyundai Ioniq electric Hyundai        Ioniq electric                311
38.3                       184500
Hyundai Kona electric 39.2kWh Hyundai Kona electric 39.2kWh                289
39.2                       154400

==============================
Kia
```

```
==============================
     Car full name Make          Model  Range (WLTP) [km]  Battery capacity [kWh]
Minimal price (gross) [PLN]
Kia e-Niro 39.2kWh  Kia e-Niro 39.2kWh                289                    39.2
146990
Kia e-Soul 39.2kWh  Kia e-Soul 39.2kWh                276                    39.2
139900

==============================
Mazda
==============================
Car full name  Make Model  Range (WLTP) [km]  Battery capacity [kWh]  Minimal pri
ce (gross) [PLN]
  Mazda MX-30 Mazda MX-30                200                    35.5
142900

==============================
Mercedes-Benz
==============================
           Car full name          Make      Model  Range (WLTP) [km]  Battery cap
acity [kWh]  Minimal price (gross) [PLN]
Mercedes-Benz EQV (long) Mercedes-Benz EQV (long)                356
90.0                       339480

==============================
Mini
==============================
 Car full name Make     Model  Range (WLTP) [km]  Battery capacity [kWh]  Minimal
price (gross) [PLN]
Mini Cooper SE Mini Cooper SE                234                    28.9
139900

==============================
Nissan
==============================
        Car full name   Make          Model  Range (WLTP) [km]  Battery capacity
[kWh]  Minimal price (gross) [PLN]
          Nissan Leaf Nissan           Leaf                270
40.0                       122900
       Nissan Leaf e+ Nissan        Leaf e+                385
62.0                       164000
Nissan e-NV200 evalia Nissan e-NV200 evalia                200
40.0                       164328

==============================
Opel
==============================
Car full name Make   Model  Range (WLTP) [km]  Battery capacity [kWh]  Minimal pr
ice (gross) [PLN]
 Opel Corsa-e Opel Corsa-e                337                    50.0
128900
 Opel Mokka-e Opel Mokka-e                324                    50.0
139900

==============================
Peugeot
==============================
 Car full name    Make  Model  Range (WLTP) [km]  Battery capacity [kWh]  Minimal
price (gross) [PLN]
 Peugeot e-208 Peugeot  e-208                340                    50.0
```

```
124900
Peugeot e-2008 Peugeot e-2008                320                      50.0
149400

==============================
Renault
==============================
   Car full name     Make     Model  Range (WLTP) [km]  Battery capacity [kWh]  Min
imal price (gross) [PLN]
Renault Zoe R110 Renault Zoe R110                395                      52.0
135900
Renault Zoe R135 Renault Zoe R135                395                      52.0
142900

==============================
Skoda
==============================
    Car full name  Make        Model  Range (WLTP) [km]  Battery capacity [kWh]  M
inimal price (gross) [PLN]
Skoda Citigo-e iV Skoda Citigo-e iV                260                      36.8
82050

==============================
Smart
==============================
   Car full name  Make      Model  Range (WLTP) [km]  Battery capacity [kWh]  Min
imal price (gross) [PLN]
 Smart fortwo EQ Smart  fortwo EQ                154                      17.6
96900
Smart forfour EQ Smart forfour EQ                148                      17.6
98900

==============================
Volkswagen
==============================
   Car full name       Make Model  Range (WLTP) [km]  Battery capacity [kWh]  Min
imal price (gross) [PLN]
Volkswagen e-up! Volkswagen e-up!                258                      32.3
97990
```

In [ ]:

```python
import pandas as pd
df=pd.read_excel("FEV-data-Excel.xlsx")
df
```

In [25]:

```python
# Group and calculate mean(AVERAGE OF BATTERY CAPACITY BY MAKERS)
avg_capacity = df.groupby("Make")["Battery capacity [kWh]"].mean().reset_index()

# Rename the columns
avg_capacity.columns = ["Make", "Average battery capacity (kWh)"]
print(avg_capacity)
```

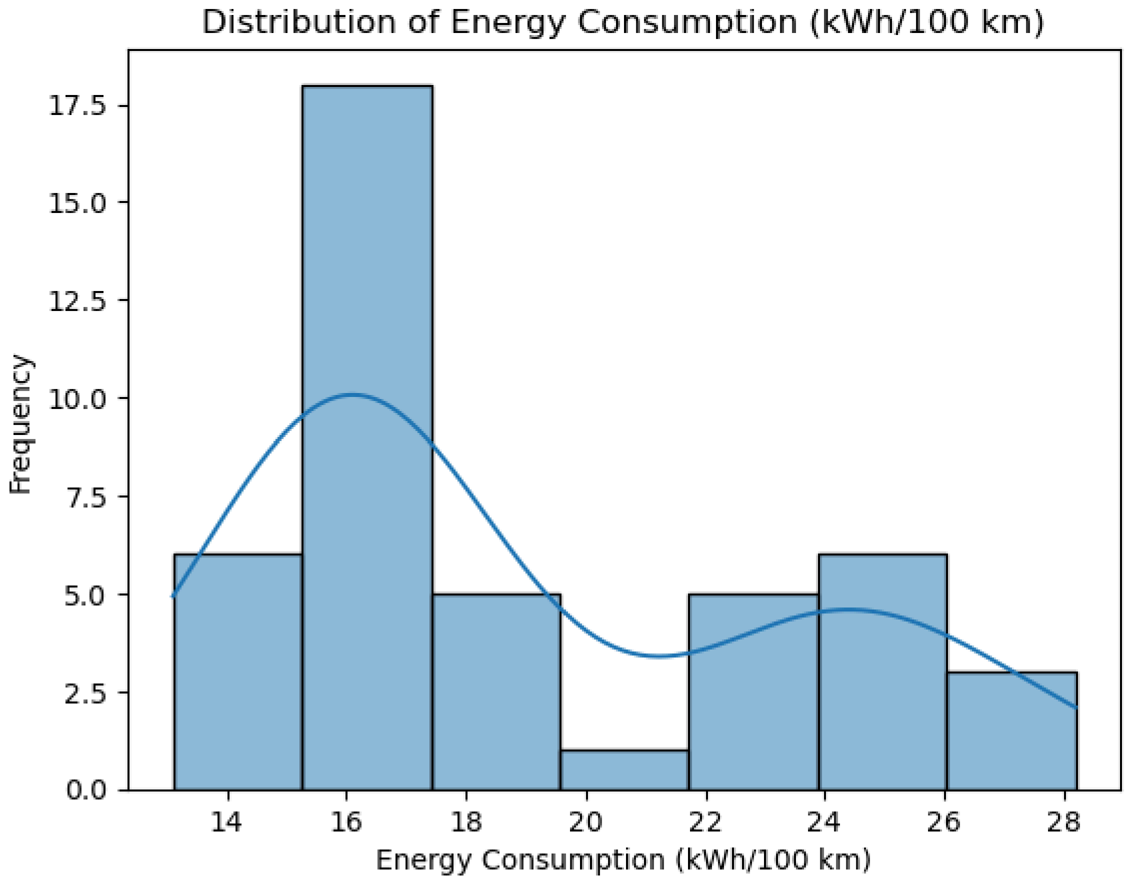
```
                Make  Average battery capacity (kWh)
0               Audi                       87.000000
1                BMW                       54.800000
2            Citroën                       50.000000
3                 DS                       50.000000
4              Honda                       35.500000
5            Hyundai                       47.166667
6             Jaguar                       90.000000
7                Kia                       51.600000
8              Mazda                       35.500000
9      Mercedes-Benz                       85.000000
10              Mini                       28.900000
11            Nissan                       47.333333
12              Opel                       50.000000
13           Peugeot                       50.000000
14           Porsche                       89.850000
15           Renault                       52.000000
16             Skoda                       36.800000
17             Smart                       17.600000
18             Tesla                       86.285714
19        Volkswagen                       61.075000
```

TASK=2

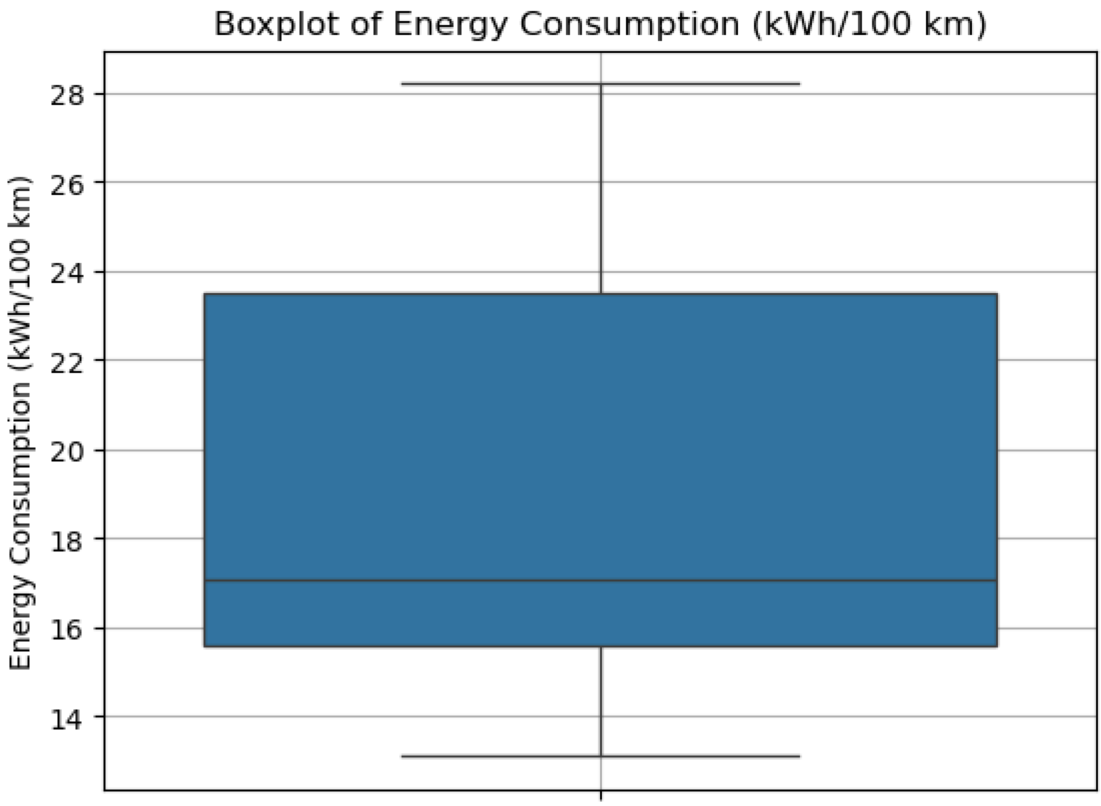
In [48]:
```
import seaborn as sns
import matplotlib.pyplot as plt
df.columns = df.columns.str.strip()
print(df.columns)
```

```
Index(['Car full name', 'Make', 'Model', 'Minimal price (gross) [PLN]',
       'Engine power [KM]', 'Maximum torque [Nm]', 'Type of brakes',
       'Drive type', 'Battery capacity [kWh]', 'Range (WLTP) [km]',
       'Wheelbase [cm]', 'Length [cm]', 'Width [cm]', 'Height [cm]',
       'Minimal empty weight [kg]', 'Permissable gross weight [kg]',
       'Maximum load capacity [kg]', 'Number of seats', 'Number of doors',
       'Tire size [in]', 'Maximum speed [kph]', 'Boot capacity (VDA) [l]',
       'Acceleration 0-100 kph [s]', 'Maximum DC charging power [kW]',
       'mean - Energy consumption [kWh/100 km]'],
      dtype='object')
```

In [46]:
```
sns.histplot(df["mean - Energy consumption [kWh/100 km]"], kde=True)
plt.title("Distribution of Energy Consumption (kWh/100 km)")
plt.xlabel("Energy Consumption (kWh/100 km)")
plt.ylabel("Frequency")
plt.show()
# You can see the energy consumption mean according to frequency
```



In [66]:
```
sns.boxplot(y=df["mean - Energy consumption [kWh/100 km]"], showfliers=True)
plt.title("Boxplot of Energy Consumption (kWh/100 km)")
plt.ylabel("Energy Consumption (kWh/100 km)")
plt.grid(True)
plt.show()
```



The thick line inside the box shows the median energy consumption. Most vehicles consume around 17 kWh/100 km.

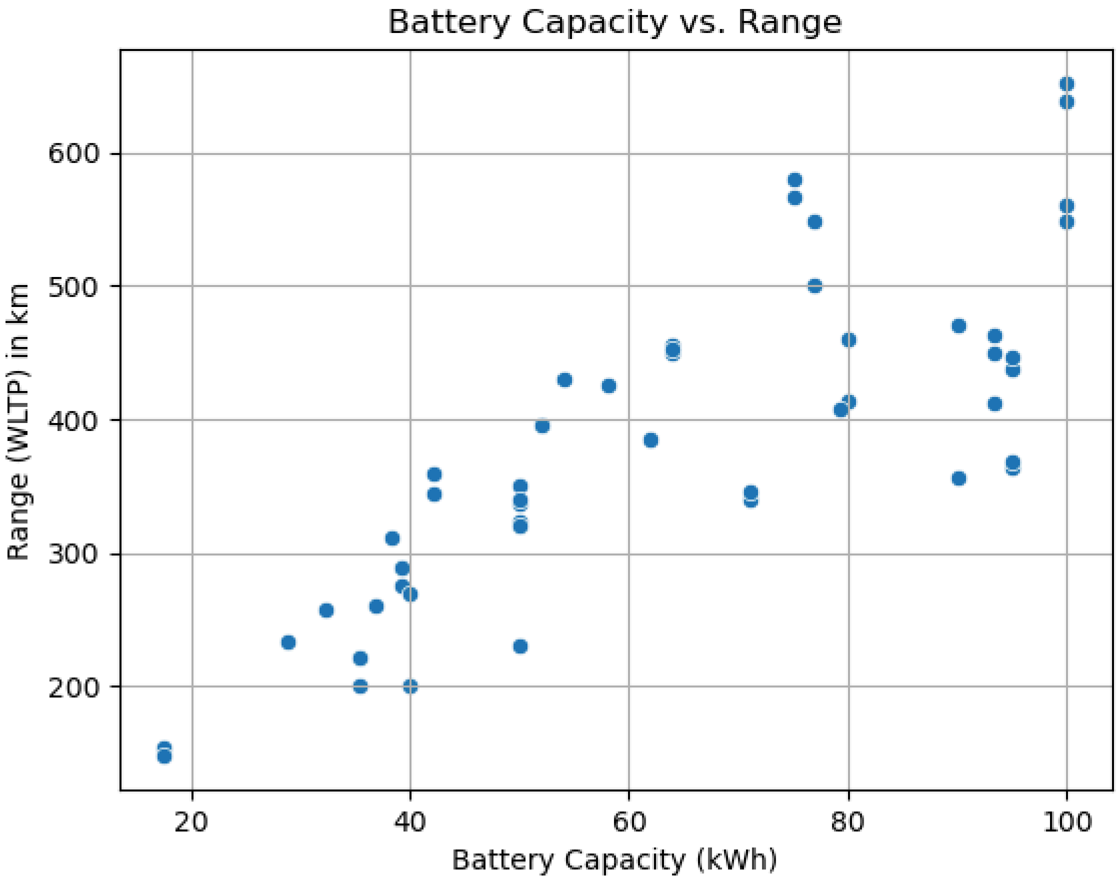
It does not show dots outside aiming, so it doesn't have extreme outliers as shown in the boxplot

The box spans from around 15 to 24 kWh/100 km. This indicates that 50% of vehicles fall in this range.

In [ ]:
```
There are significant variations in energy consumption across manufacturers, wit
##These high and low outliers can skew the interpretation of overall energy effi
##Let's explore and visualize these patterns to understand energy performance ex
```

TASK=3

In [73]:
```
sns.scatterplot(x='Battery capacity [kWh]', y='Range (WLTP) [km]', data=df)
plt.title("Battery Capacity vs. Range")
plt.xlabel("Battery Capacity (kWh)")
plt.ylabel("Range (WLTP) in km")
plt.grid(True)
plt.show()
```



Vehicles with larger batteries generally have a longer range, as seen in the upward trend of the scatter plot.

If the dots generally move upward to the right, it means more battery = more range (positive correlation).

its a positive correlation between battery and range

There are noticeable clusters of vehicles at certain battery capacities, for instance:

Around 35-40 kWh Around 50-55 kWh Around 75-80 kWh Around 95-100 kWh

Talking about outliers\high performance, the points above 600 range at 98-100 kWh. These might represent highly optimized or premium vehicles.

The plot indicates that larger battery capacities generally lead to greater range

The data doesn't clearly show a strong curve, but the increasing spread could hint at it, or simply more diverse vehicle types in higher capacity segments.

TASK=4

In [1]:
```python
import pandas as pd

class recommendation:
    def putdata(self):
        self.budget = float(input("Enter Your budget: "))
        self.desired_range = int(input("Enter Your Range for EV: "))
        self.battery_capacity = int(input("Battery Capacity You need in EV: "))

    def display(self):
        print("Recommendation budget:", self.budget)
        print("Recommendation desired range:", self.desired_range)
        print("Recommendation battery capacity:", self.battery_capacity)

        # Load data from Excel
        df = pd.read_excel("FEV-data-Excel.xlsx")

        # Filter based on user's input
        filtered = df[
            (df["Minimal price (gross) [PLN]"] <= self.budget) &
            (df["Range (WLTP) [km]"] >= self.desired_range) &
            (df["Battery capacity [kWh]"] >= self.battery_capacity)]

        # Sort by budget (ascending)
        filtered = filtered.sort_values(by="Minimal price (gross) [PLN]")

        # Display top 3 matches
        top_ev = filtered.head(3)

        if not top_ev.empty:
            print("\nTop EV recommendations for you:")
            print(top_ev)
        else:
            print("\nNo EVs match your criteria.")

# Instantiate and run
a = recommendation()
a.putdata()
a.display()
```

```
Recommendation budget: 350000.0
Recommendation desired range: 400
Recommendation battery capacity: 70

Top EV recommendations for you:
                Car full name        Make                 Model  \
48     Volkswagen ID.3 Pro S  Volkswagen          ID.3 Pro S
49       Volkswagen ID.4 1st  Volkswagen            ID.4 1st
40  Tesla Model 3 Long Range       Tesla  Model 3 Long Range

    Minimal price (gross) [PLN]  Engine power [KM]  Maximum torque [Nm]  \
48                       179990                204                  310
49                       202390                204                  310
40                       235490                372                  510

               Type of brakes  Drive type  Battery capacity [kWh]  \
48  disc (front) + drum (rear)  2WD (rear)                    77.0
49  disc (front) + drum (rear)  2WD (rear)                    77.0
40         disc (front + rear)        4WD                    75.0

    Range (WLTP) [km]  ...  Permissable gross weight [kg]  \
48                549  ...                         2280.0
49                500  ...                         2660.0
40                580  ...                            NaN

    Maximum load capacity [kg]  Number of seats  Number of doors  \
48                       412.0                5                5
49                       661.0                5                5
40                         NaN                5                5

    Tire size [in]  Maximum speed [kph]  Boot capacity (VDA) [l]  \
48              19                  160                    385.0
49              20                  160                    543.0
40              18                  233                    425.0

    Acceleration 0-100 kph [s]  Maximum DC charging power [kW]  \
48                         7.9                             125
49                         8.5                             125
40                         4.4                             150

    mean - Energy consumption [kWh/100 km]
48                                    15.9
49                                    18.0
40                                     NaN

[3 rows x 25 columns]
```

TASK=5

In [14]:

```python
from scipy.stats import ttest_ind
# Data of two companies as a list
tesla_power = [285, 372, 480, 525, 772, 525, 772]
audi_power = [360, 313, 503, 313, 360, 503]
# Compute averages
avg_tesla = sum(tesla_power) / len(tesla_power)
avg_audi = sum(audi_power) / len(audi_power)
# Perform a two-step t-test
t_stat, p_value = ttest_ind(tesla_power, audi_power, equal_var=False)
# Print results
```

```python
print(f"Tesla Average Power: {avg_tesla:.2f} KM")
print(f"Audi Average Power: {avg_audi:.2f} KM")
print(f"T-statistic: {t_stat:.3f}")
print(f"P-value: {p_value:.4f}")
```

```
Tesla Average Power: 533.00 KM
Audi Average Power: 392.00 KM
T-statistic: 1.794
P-value: 0.1068
```

Conclusion: Reject H_0 – significant difference in engine power.

Insights

In [ ]:

```
Tesla's vehicles have significantly higher average engine power (533 KM) than Au
This means the difference in engine power is statistically significant.
Although the p-value suggests the result is not statistically significant, the 1
practically meaningful to consumers or engineers
```

$p = 0.1068 > 0.05$

We fail to reject the null hypothesis. This means there is no statistically significant difference in engine power between Tesla and Audi vehicles at the 5% significance level.

In [ ]:

```
## RECOMMENDATIONS
Investigate whether factors like car model, engine , or weight affect engine pow
Include a measure like Cohen's d to understand the practical magnitude of the di
A larger sample might reduce variability and reveal a significant effect if it e
```

video link-

https://drive.google.com/file/d/1Yf1sN6VIvlRzeSWp-jZVl5ptkLwggOl6/view?usp=sharing

click the box when uh see hand sign