Report on EV Market Segmentation

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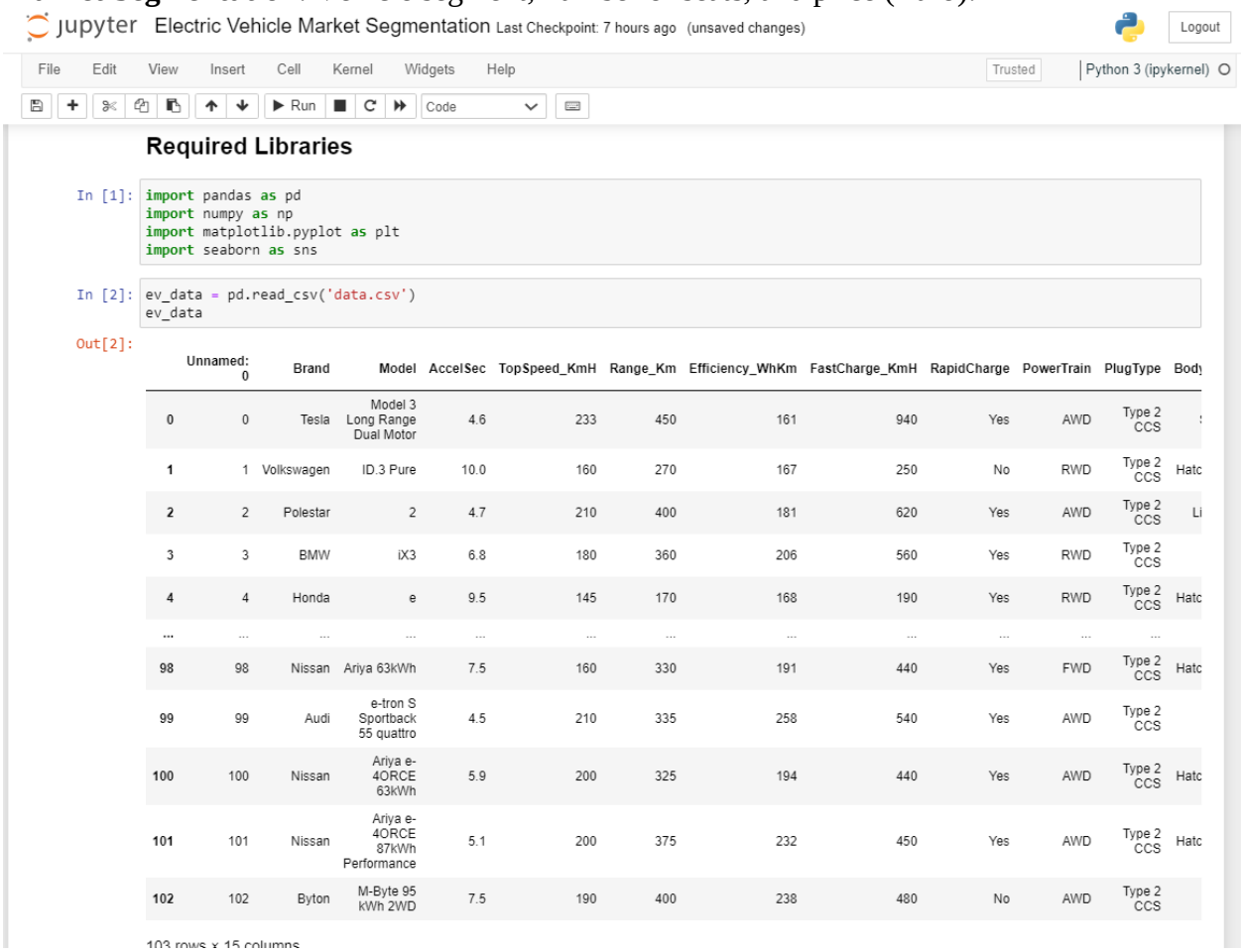
1. Introduction

The electric vehicle (EV) market has seen significant growth over recent years. Various factors such as performance, range, price, and body style influence consumer choice. This report analyzes the segmentation of the EV market based on a provided dataset, which includes various specifications and characteristics of different EV models.

2. Data Overview The dataset contains information on 86 different EV models from various brands. Key variables include:

- **Performance**: Acceleration (0-100 km/h in seconds), top speed (km/h), and powertrain.
- **Range and Efficiency**: Range (km), efficiency (Wh/km), and fast charge capabilities (km/h).
- **Features**: Rapid charge availability, plug type, and body style.

- **Market Segmentation**: Vehicle segment, number of seats, and price (Euro).



Required Libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:
```
ev_data = pd.read_csv('data.csv')
ev_data
```

Out[2]:

	Unnamed: 0	Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType	Body
0	0	Tesla	Model 3 Long Range Dual Motor	4.6	233	450	161	940	Yes	AWD	Type 2 CCS	
1	1	Volkswagen	ID.3 Pure	10.0	160	270	167	250	No	RWD	Type 2 CCS	Hatc
2	2	Polestar	2	4.7	210	400	181	620	Yes	AWD	Type 2 CCS	Li
3	3	BMW	iX3	6.8	180	360	206	560	Yes	RWD	Type 2 CCS	
4	4	Honda	e	9.5	145	170	168	190	Yes	RWD	Type 2 CCS	Hatc
...	...	...	...	...	...	...	...	...	...	...	...	
98	98	Nissan	Ariya 63kWh	7.5	160	330	191	440	Yes	FWD	Type 2 CCS	Hatc
99	99	Audi	e-tron S Sportback 55 quattro	4.5	210	335	258	540	Yes	AWD	Type 2 CCS	
100	100	Nissan	Ariya e-4ORCE 63kWh	5.9	200	325	194	440	Yes	AWD	Type 2 CCS	Hatc
101	101	Nissan	Ariya e-4ORCE 87kWh Performance	5.1	200	375	232	450	Yes	AWD	Type 2 CCS	Hatc
102	102	Byton	M-Byte 95 kWh 2WD	7.5	190	400	238	480	No	AWD	Type 2 CCS	

103 rows x 15 columns

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Run Code

103 rows × 15 columns

In [3]:
```
# Last five record

ev_data.tail()
```

Out[3]:

	Unnamed: 0	Brand	Model	AccelSec	TopSpeed_KmH	Range_Km	Efficiency_WhKm	FastCharge_KmH	RapidCharge	PowerTrain	PlugType	BodyStyl
98	98	Nissan	Ariya 63kWh	7.5	160	330	191	440	Yes	FWD	Type 2 CCS	Hatchbac
99	99	Audi	e-tron S Sportback 55 quattro	4.5	210	335	258	540	Yes	AWD	Type 2 CCS	SU
100	100	Nissan	Ariya e-4ORCE 63kWh	5.9	200	325	194	440	Yes	AWD	Type 2 CCS	Hatchbac
101	101	Nissan	Ariya e-4ORCE 87kWh Performance	5.1	200	375	232	450	Yes	AWD	Type 2 CCS	Hatchbac
102	102	Byton	M-Byte 95 kWh 2WD	7.5	190	400	238	480	No	AWD	Type 2 CCS	SU

In [4]:
```
# Size of the dataset

ev_data.shape
```

Out[4]: (103, 15)

In [5]:
```
# columns in the data

ev_data.columns
```

Out[5]:
```
Index(['Unnamed: 0', 'Brand', 'Model', 'AccelSec', 'TopSpeed_KmH', 'Range_Km',
       'Efficiency_WhKm', 'FastCharge_KmH', 'RapidCharge', 'PowerTrain',
       'PlugType', 'BodyStyle', 'Segment', 'Seats', 'PriceEuro'],
      dtype='object')
```

In [6]:
```
ev_data.info()
```

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```
 14  PriceEuro        103 non-null    int64
dtypes: float64(1), int64(7), object(7)
memory usage: 12.2+ KB
```

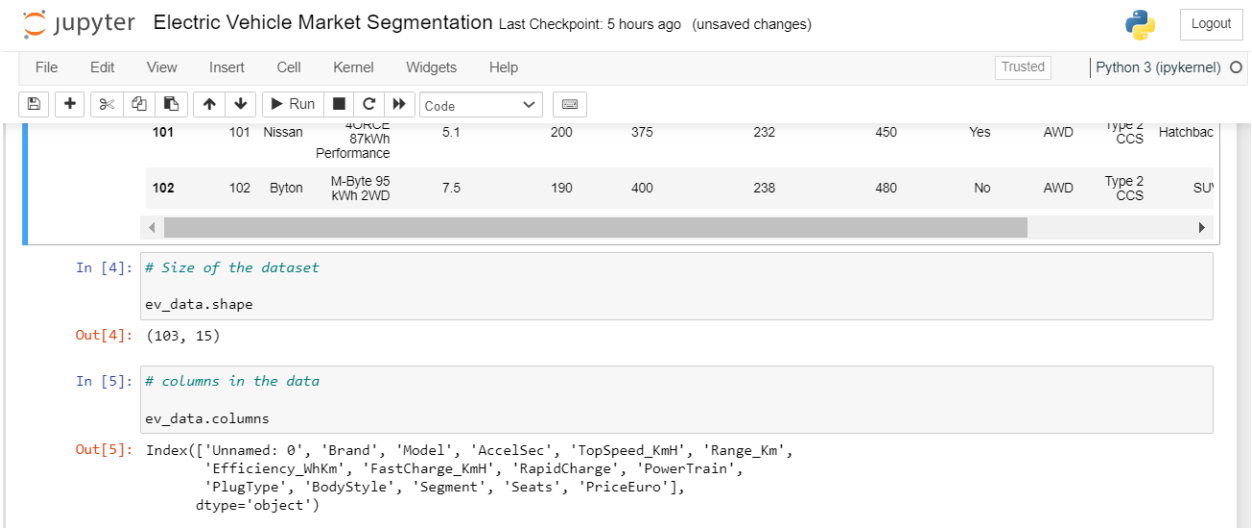
In [7]:
```
# Null values in the data

ev_data.isnull().sum()
```

Out[7]:
```
Unnamed: 0         0
Brand              0
Model              0
AccelSec           0
TopSpeed_KmH       0
Range_Km           0
Efficiency_WhKm    0
FastCharge_KmH     0
RapidCharge        0
PowerTrain         0
PlugType           0
BodyStyle          0
Segment            0
Seats              0
PriceEuro          0
dtype: int64
```

In [8]:
```
# check duplicate values

ev_data.duplicated().sum()
```



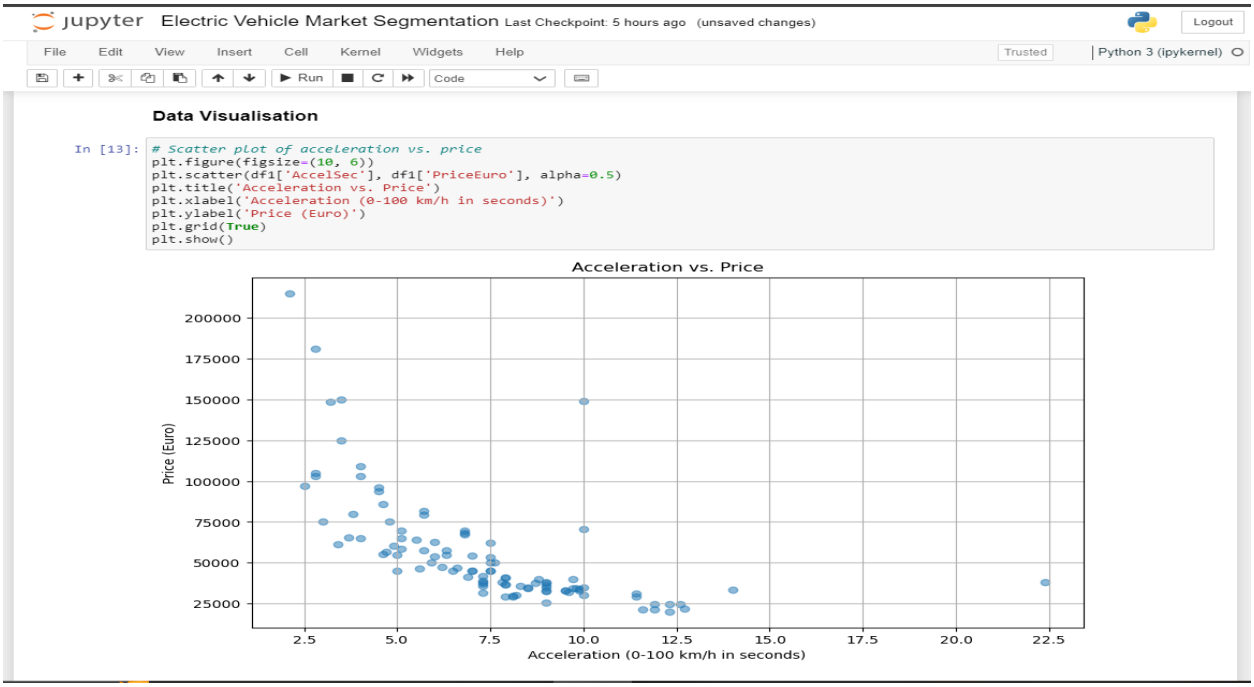
3. Market Segmentation Analysis

3.1 By Brand

- **Top Brands**: Tesla, Volkswagen, Audi, BMW, and Nissan have a significant presence in the dataset.
- **Diversity**: Brands offer multiple models targeting different segments and price ranges.

3.2 By Acceleration

- **High Performance**: Models like the Tesla Roadster (2.1 sec), Lucid Air (2.8 sec), and Porsche Taycan Turbo S (2.8 sec) cater to performance enthusiasts.
- **Economy Options**: Models with slower acceleration, such as the Skoda CITIGOe iV (12.3 sec) and Smart EQ forfour (12.7 sec), are targeted at urban commuters.



3.3 By Top Speed

- **High Speed**: The Tesla Roadster (410 km/h) and various Porsche models offer top speeds exceeding 250 km/h.
- **Moderate Speed**: Most economy and mid-range models have top speeds between 130-200 km/h.

3.4 By Range

- **Long Range**: Tesla Cybertruck Tri Motor (750 km) and Lucid Air (610 km) lead in range, appealing to long-distance travelers.
- **Mid-Range**: Many models, including those from Nissan and Hyundai, offer ranges between 250-400 km, suitable for daily commutes.
- **Short Range**: Urban-focused models like the Honda e (170 km) and Renault Twingo ZE (130 km) have shorter ranges.

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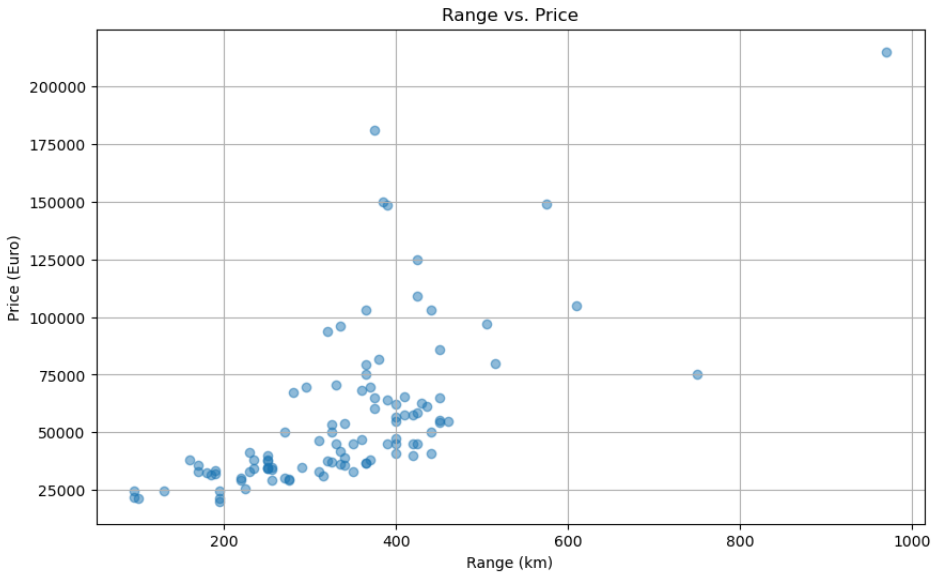
In [14]:
```
# Scatter plot of range vs. price
plt.figure(figsize=(10, 6))
plt.scatter(df1['Range_Km'], df1['PriceEuro'], alpha=0.5)
plt.title('Range vs. Price')
plt.xlabel('Range (km)')
plt.ylabel('Price (Euro)')
plt.grid(True)
plt.show()
```



3.5 By Price

- **Luxury Segment**: Vehicles like the Tesla Roadster (€215,000) and Porsche Taycan Turbo S (€180,781) cater to the high-end market.
- **Mid-Range**: Models like the Tesla Model 3 (€46,380 - €65,620) and Audi e-tron (€67,358) cater to the mid-market segment.
- **Budget-Friendly**: Affordable options include the Renault Zoe (€29,234) and Volkswagen e-Up! (€21,421).

3.6 By Body Style

- **Sedans**: Popular for their balance of performance and practicality, with models like the Tesla Model S and Audi e-tron GT.
- **SUVs**: Highly popular for their versatility, with entries from Tesla, Audi, and Volkswagen.
- **Hatchbacks**: Suitable for city driving, with models like the Nissan Leaf and Volkswagen ID.3.
- **Other**: Includes pickups (Tesla Cybertruck), liftbacks (Polestar 2), and cabrios (Tesla Roadster).

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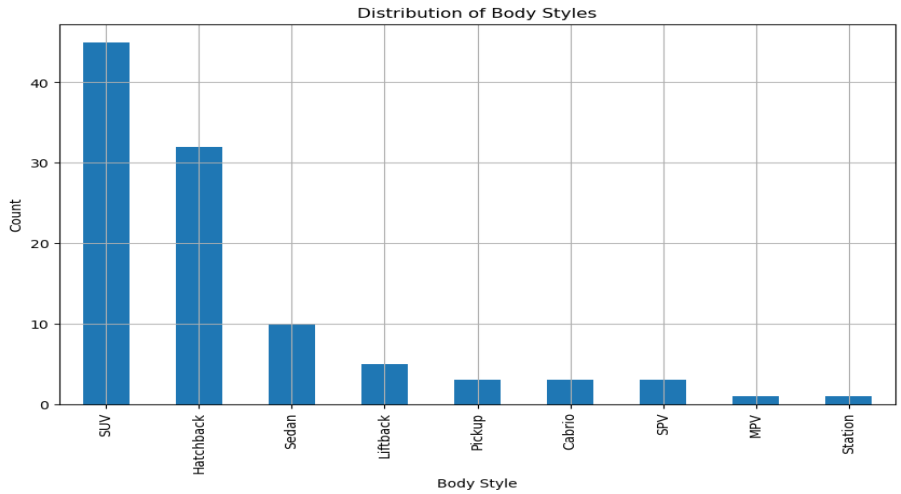
In [15]:
```
# Bar chart of body styles
plt.figure(figsize=(10, 6))
df1['BodyStyle'].value_counts().plot(kind='bar')
plt.title('Distribution of Body Styles')
plt.xlabel('Body Style')
plt.ylabel('Count')
plt.grid(True)
plt.show()
```



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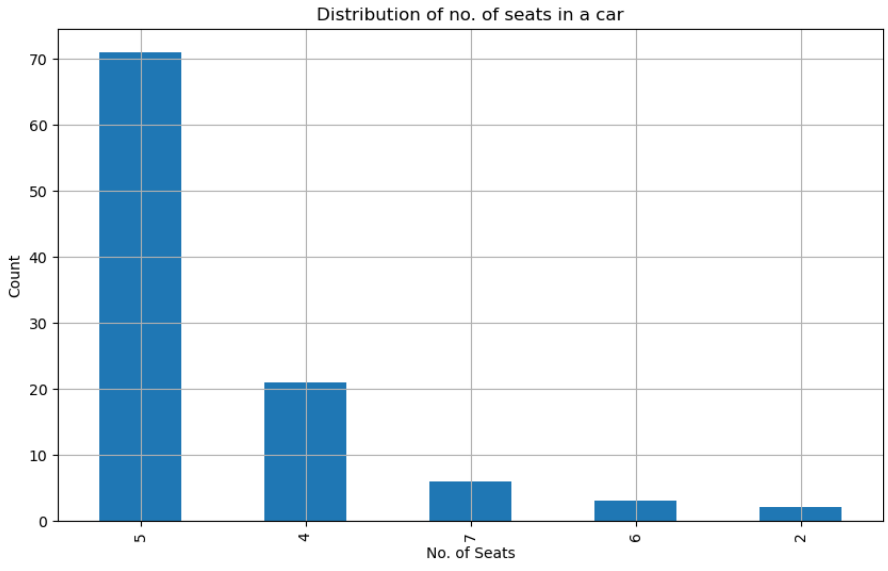
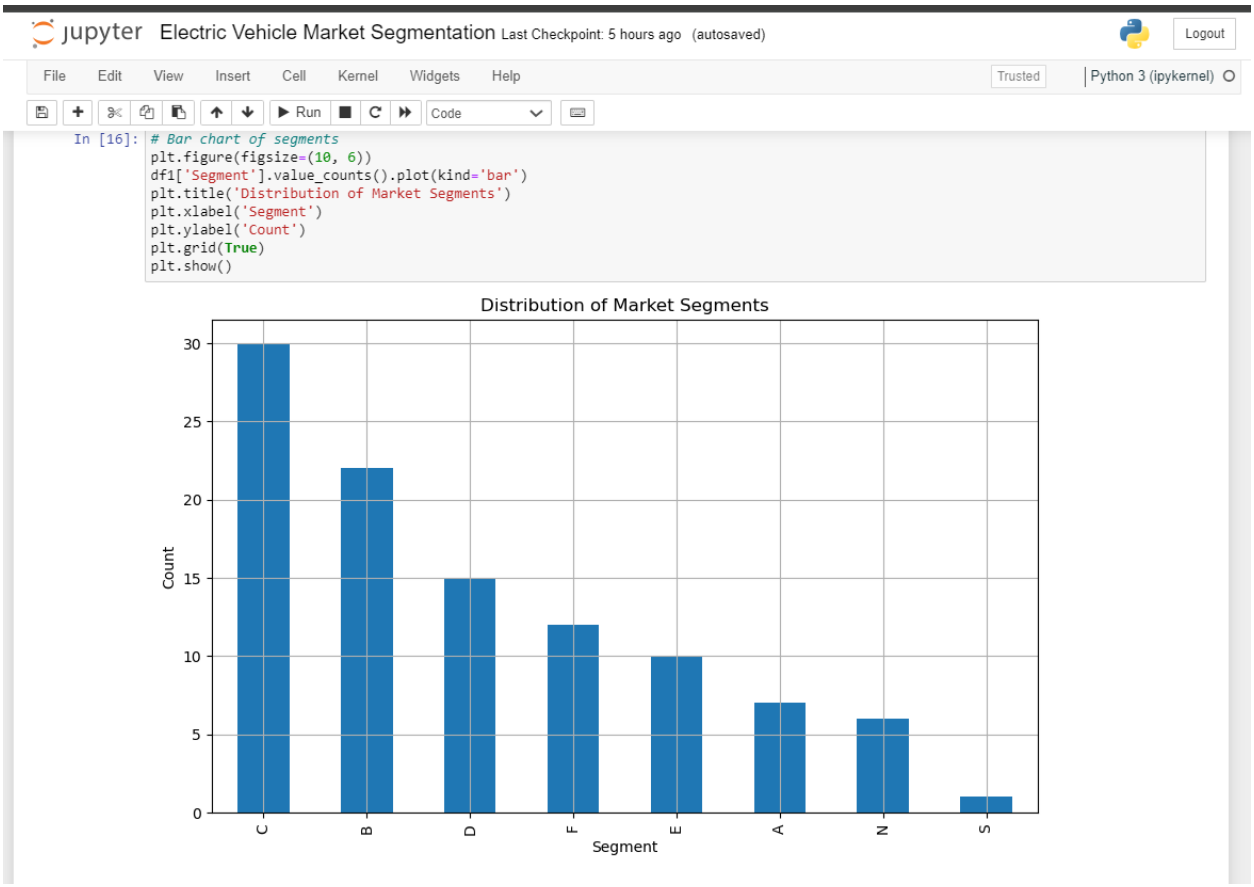
Run Code

In [17]:
```
# Bar chart for no. of seats
plt.figure(figsize=(10, 6))
df1['Seats'].value_counts().plot(kind='bar')
plt.title('Distribution of no. of seats in a car')
plt.xlabel('No. of Seats')
plt.ylabel('Count')
plt.grid(True)
plt.show()
```



3.7 By Segment

- **Luxury (F Segment)**: High-end sedans and performance vehicles like the Lucid Air and Porsche Taycan.
- **Upper Medium (D Segment)**: Balanced options for performance and price, such as the Tesla Model 3 and Audi Q4 e-tron.
- **Lower Medium (C Segment)**: Practical vehicles like the Volkswagen ID.3 and Nissan Leaf.
- **Small (B Segment)**: Compact cars like the Peugeot e-208 and Opel Corsa-e.
- **Mini (A Segment)**: Urban-focused models like the Skoda CITIGOe iV and Smart EQ fortwo.



3.8 By Powertrain

- **AWD**: Common in high-performance and luxury models, enhancing traction and stability.
- **RWD**: Often seen in performance-oriented models and some budget options.
- **FWD**: Predominant in economy and compact models, offering simplicity and cost efficiency.

3.9 By Rapid Charge Capability

- **With Rapid Charge**: Most models offer rapid charge capabilities, essential for long-distance travel.
- **Without Rapid Charge**: Some budget models lack this feature, making them more suitable for short-range city driving.

4. Conclusion

- The EV market segmentation reveals a diverse range of vehicles catering to different consumer needs, from high-performance luxury cars to practical city commuters.

- Key trends include the prominence of **SUV body styles**, the importance of **rapid charging capabilities**, and the **wide range of prices and performance specifications**.

-Brands like Tesla and Volkswagen dominate the market with varied offerings across multiple segments.