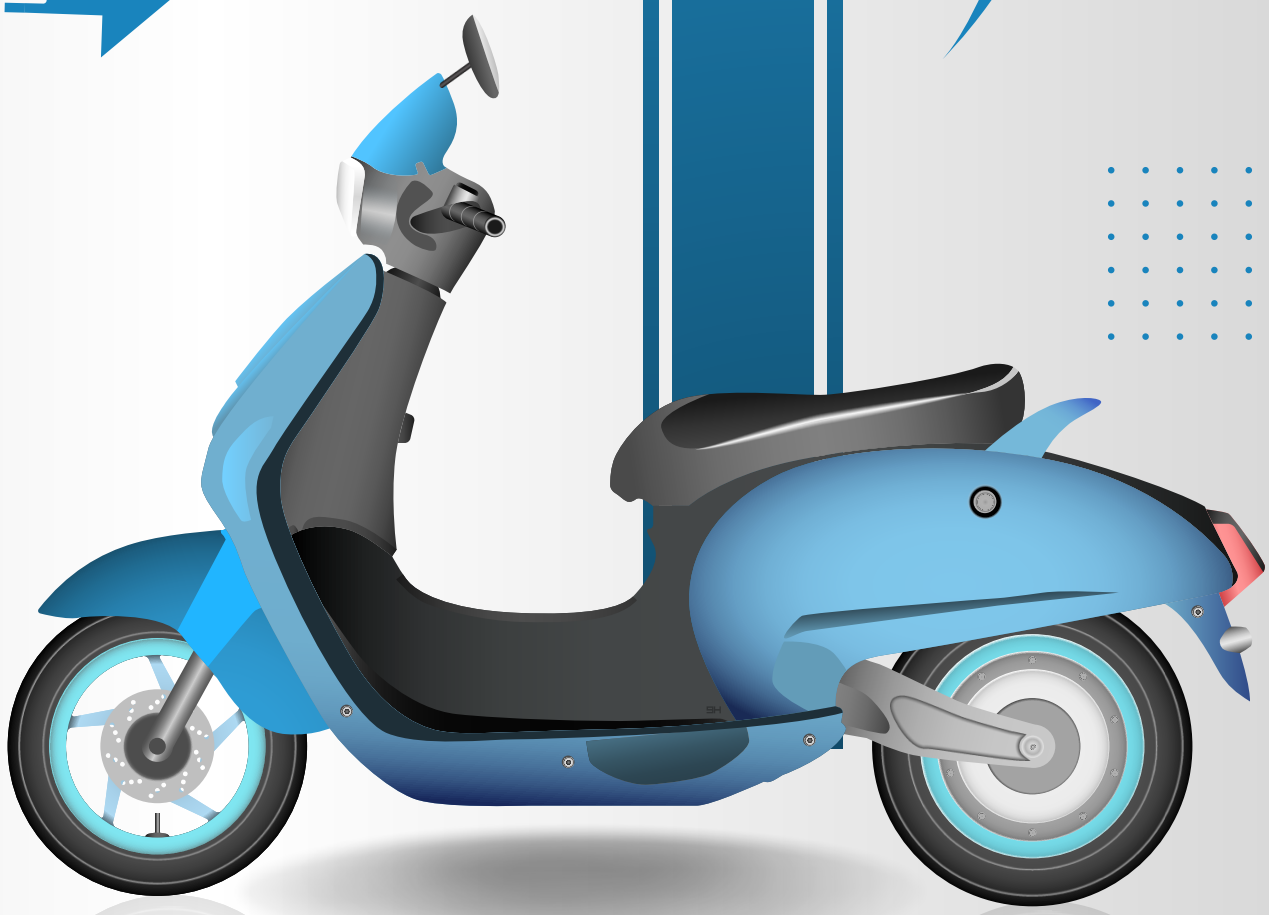
ELECTRIC VEHICLES SALE PROJECT

UJJAWAL VALIYA

Drive into the Future with Our Limited-Time Electric Vehicle

PROJECT



ELECTRIC VEHICLE SALE ANALYSIS PROJECT

GO GREEN
SAVE GREEN

We're leading the charge towards a cleaner, greener future with our comprehensive electric vehicle (EV) and charging station services

Timmerman Industries
123 Anywhere St., Any City

Charging Station

Charging Location
123 Anywhere St., Any City

Electric vehice market sales

```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd

ev_data = pd.read_csv('Electric_Vehicle_Population_Data.csv')

print(ev_data.head())
```

```
   VIN (1-10)     County       City State  Postal Code  Model Year   Make  \
0  5YJYGDEE1L       King    Seattle    WA      98122.0        2020  TESLA
1  7SAYGDEE9P  Snohomish    Bothell    WA      98021.0        2023  TESLA
2  5YJSA1E4XK       King    Seattle    WA      98109.0        2019  TESLA
3  5YJSA1E27G       King   Issaquah    WA      98027.0        2016  TESLA
4  5YJYGDEE5M     Kitsap  Suquamish    WA      98392.0        2021  TESLA

     Model           Electric Vehicle Type  \
0  MODEL Y  Battery Electric Vehicle (BEV)
1  MODEL Y  Battery Electric Vehicle (BEV)
2  MODEL S  Battery Electric Vehicle (BEV)
3  MODEL S  Battery Electric Vehicle (BEV)
4  MODEL Y  Battery Electric Vehicle (BEV)

   Clean Alternative Fuel Vehicle (CAFV) Eligibility  Electric Range  \
0           Clean Alternative Fuel Vehicle Eligible             291
1  Eligibility unknown as battery range has not b...               0
2           Clean Alternative Fuel Vehicle Eligible             270
3           Clean Alternative Fuel Vehicle Eligible             210
4  Eligibility unknown as battery range has not b...               0

   Base MSRP  Legislative District  DOL Vehicle ID  \
0          0                 37.0       125701579
1          0                  1.0       244285107
2          0                 36.0       156773144
3          0                  5.0       165103011
4          0                 23.0       205138552
```

	VIN (1-10)	County	City	State	Postal Code	Model Year	Make
0	5YJYGDEE1L	King	Seattle	WA	98122.0	2020	TESLA
1	7SAYGDEE9P	Snohomish	Bothell	WA	98021.0	2023	TESLA
2	5YJSA1E4XK	King	Seattle	WA	98109.0	2019	TESLA
3	5YJSA1E27G	King	Issaquah	WA	98027.0	2016	TESLA
4	5YJYGDEE5M	Kitsap	Suquamish	WA	98392.0	2021	TESLA

	Model	Electric Vehicle Type
0	MODEL Y	Battery Electric Vehicle (BEV)
1	MODEL Y	Battery Electric Vehicle (BEV)
2	MODEL S	Battery Electric Vehicle (BEV)
3	MODEL S	Battery Electric Vehicle (BEV)
4	MODEL Y	Battery Electric Vehicle (BEV)

	Clean Alternative Fuel Vehicle (CAFV) Eligibility	Electric Range
0	Clean Alternative Fuel Vehicle Eligible	291
1	Eligibility unknown as battery range has not b...	0
2	Clean Alternative Fuel Vehicle Eligible	270
3	Clean Alternative Fuel Vehicle Eligible	210
4	Eligibility unknown as battery range has not b...	0

	Base MSRP	Legislative District	DOL Vehicle ID
0	0	37.0	125701579
1	0	1.0	244285107
2	0	36.0	156773144
3	0	5.0	165103011
4	0	23.0	205138552

	Vehicle Location
0	POINT (-122.30839 47.610365)
1	POINT (-122.179458 47.802589)
2	POINT (-122.34848 47.632405)
3	POINT (-122.03646 47.534065)
4	POINT (-122.55717 47.733415)

	Electric Utility	2020 Census Tract
0	CITY OF SEATTLE - (WA)|CITY OF TACOMA - (WA)	5.303301e+10
1	PUGET SOUND ENERGY INC	5.306105e+10
2	CITY OF SEATTLE - (WA)|CITY OF TACOMA - (WA)	5.303301e+10
3	PUGET SOUND ENERGY INC||CITY OF TACOMA - (WA)	5.303303e+10
4	PUGET SOUND ENERGY INC	5.303594e+10

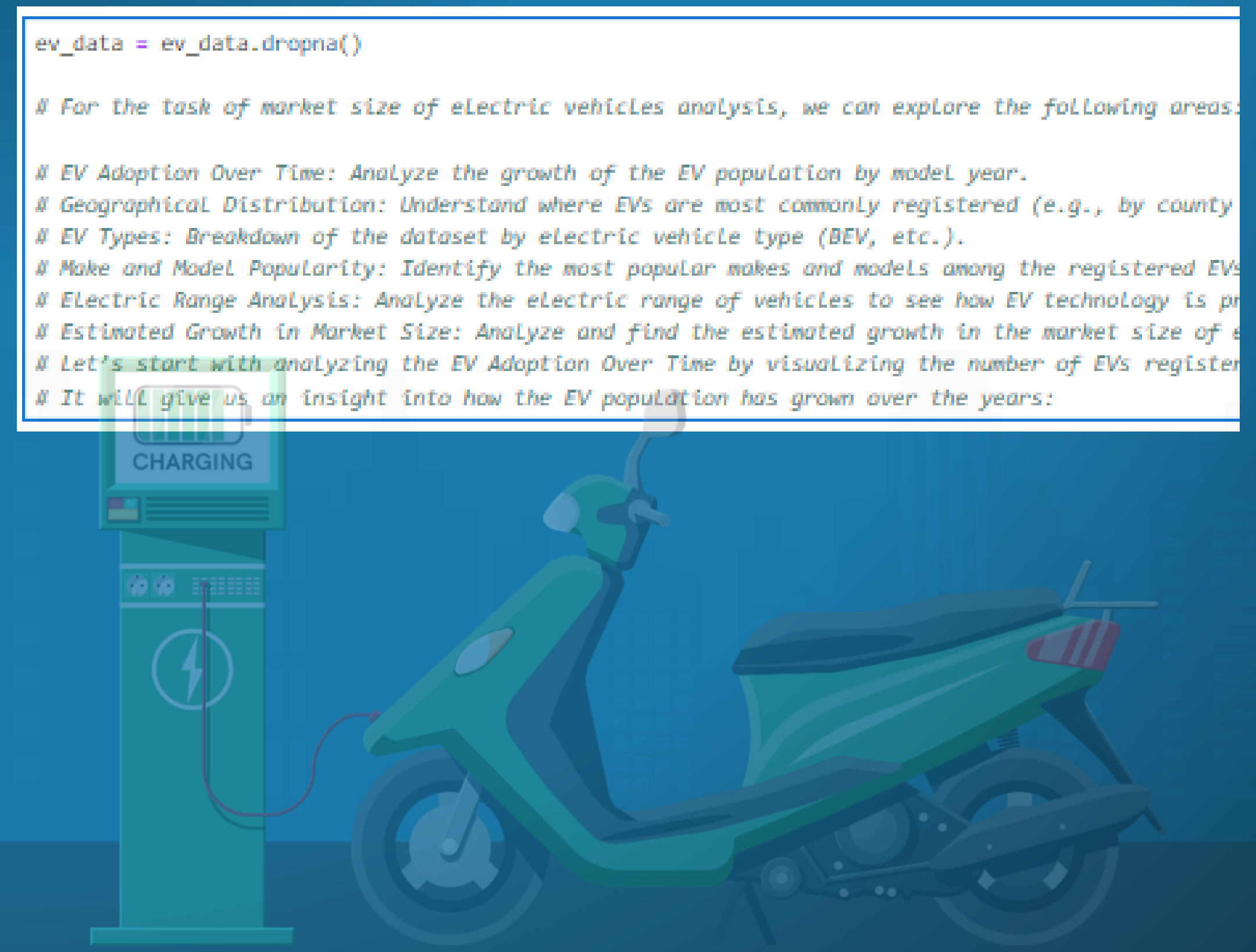
```
ev_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 177866 entries, 0 to 177865
Data columns (total 17 columns):
 #   Column                                             Non-Null Count   Dtype  
---  ------                                             --------------   -----  
 0   VIN (1-10)                                         177866 non-null  object 
 1   County                                             177861 non-null  object 
 2   City                                               177861 non-null  object 
 3   State                                              177866 non-null  object 
 4   Postal Code                                        177861 non-null  float64
 5   Model Year                                         177866 non-null  int64  
 6   Make                                               177866 non-null  object 
 7   Model                                              177866 non-null  object 
 8   Electric Vehicle Type                              177866 non-null  object 
 9   Clean Alternative Fuel Vehicle (CAFV) Eligibility  177866 non-null  object 
 10  Electric Range                                     177866 non-null  int64  
 11  Base MSRP                                          177866 non-null  int64  
 12  Legislative District                               177477 non-null  float64
 13  DOL Vehicle ID                                     177866 non-null  int64  
 14  Vehicle Location                                   177857 non-null  object 
 15  Electric Utility                                   177861 non-null  object 
 16  2020 Census Tract                                  177861 non-null  float64
dtypes: float64(3), int64(4), object(10)
memory usage: 23.1+ MB
```

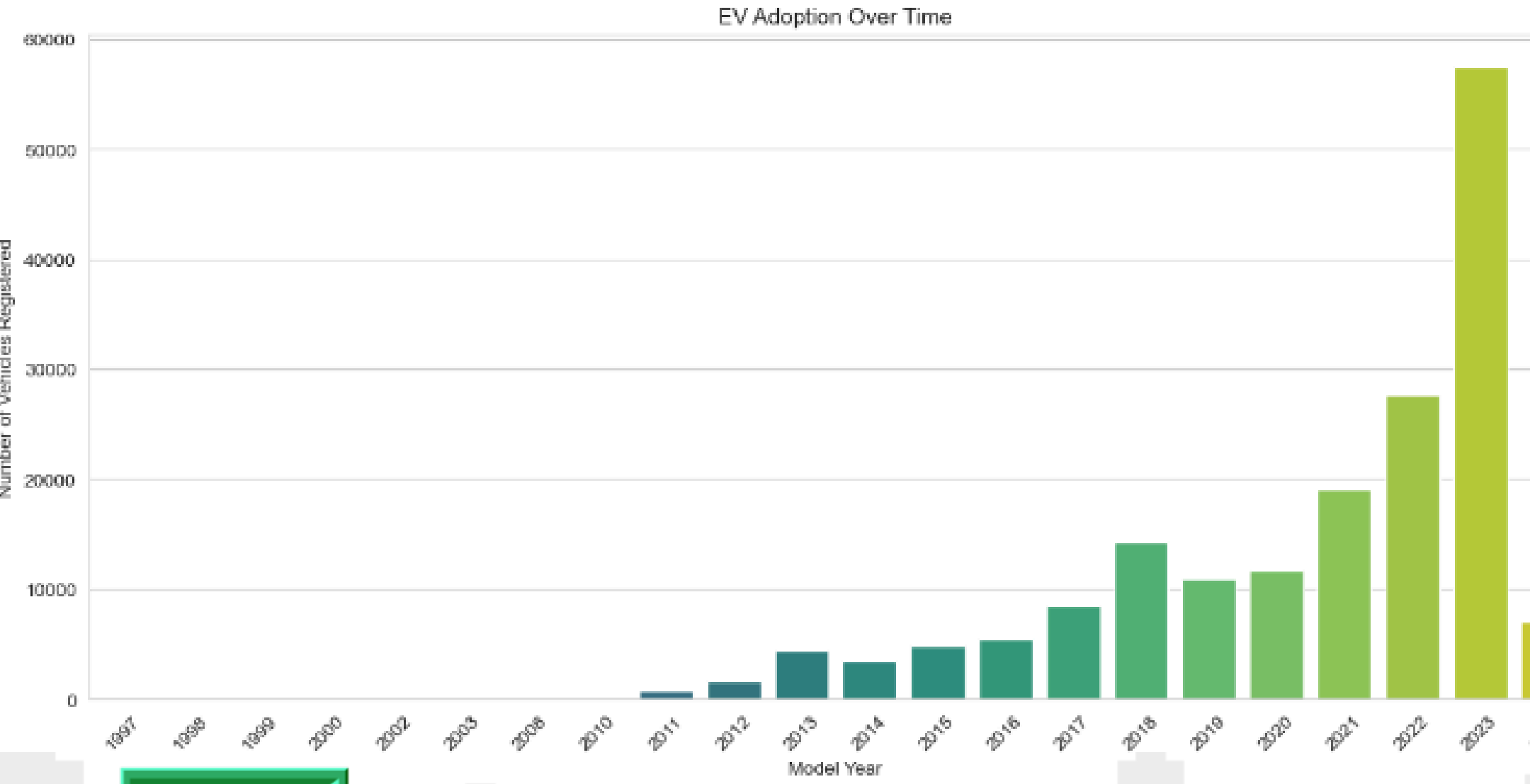
```
ev_data.isnull().sum()
```

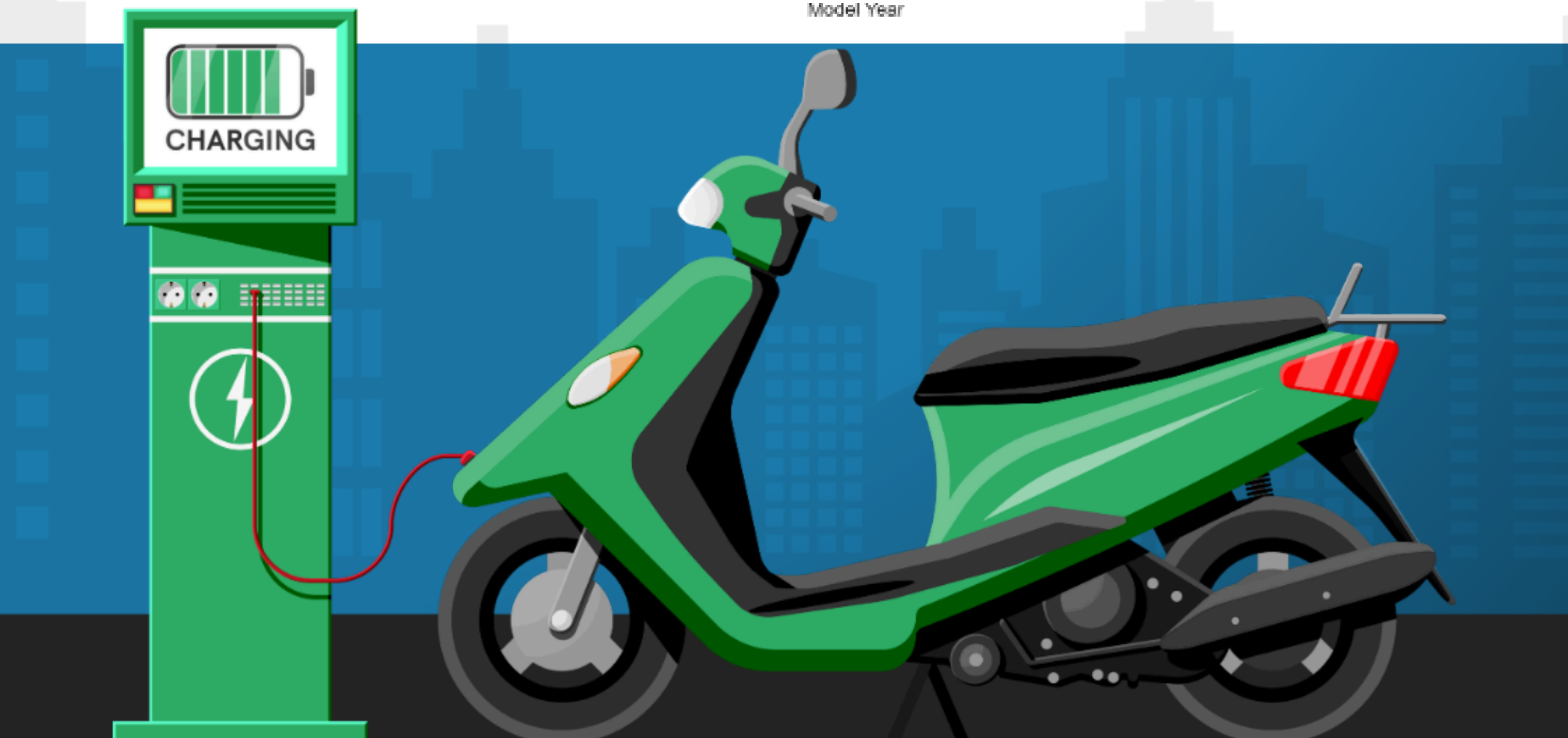
```
VIN (1-10)                                             0
County                                                 5
City                                                   5
State                                                  0
Postal Code                                            5
Model Year                                             0
Make                                                   0
Model                                                  0
Electric Vehicle Type                                  0
Clean Alternative Fuel Vehicle (CAFV) Eligibility      0
Electric Range                                         0
Base MSRP                                              0
Legislative District                                 389
DOL Vehicle ID                                         0
Vehicle Location                                       9
Electric Utility                                       5
2020 Census Tract                                      5
dtype: int64
```

```
ev_data = ev_data.dropna()

# For the task of market size of electric vehicles analysis, we can explore the following areas:

# EV Adoption Over Time: Analyze the growth of the EV population by model year.
# Geographical Distribution: Understand where EVs are most commonly registered (e.g., by county
# EV Types: Breakdown of the dataset by electric vehicle type (BEV, etc.).
# Make and Model Popularity: Identify the most popular makes and models among the registered EVs
# Electric Range Analysis: Analyze the electric range of vehicles to see how EV technology is pr
# Estimated Growth in Market Size: Analyze and find the estimated growth in the market size of e
# Let's start with analyzing the EV Adoption Over Time by visualizing the number of EVs register
# It will give us an insight into how the EV population has grown over the years:
```

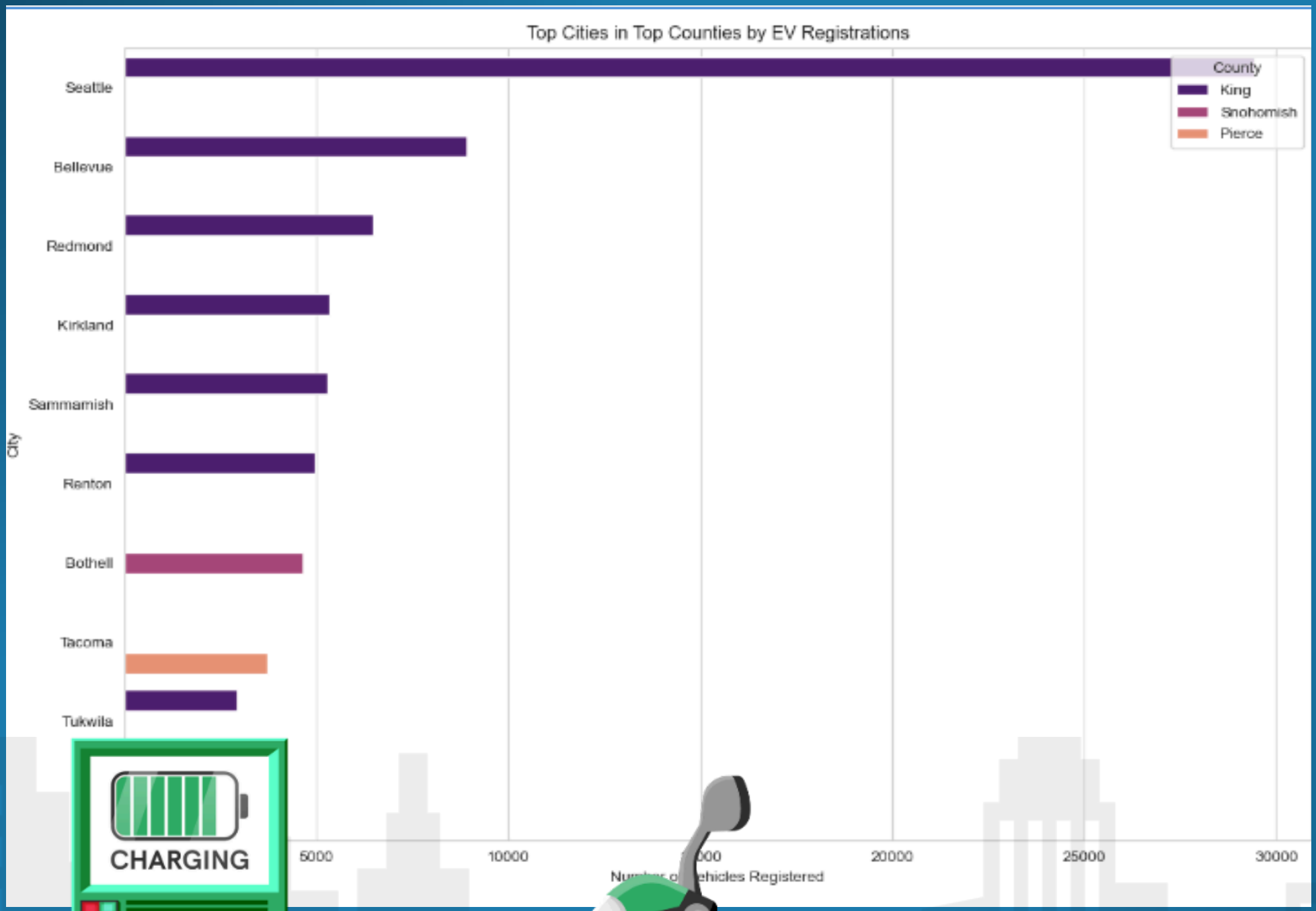


```python
import seaborn as sns
sns.set_style("whitegrid")

# EV Adoption Over Time
plt.figure(figsize=(12, 6))
ev_adoption_by_year = ev_data['Model Year'].value_counts().sort_index
sns.barplot(x=ev_adoption_by_year.index, y=ev_adoption_by_year.values
plt.title('EV Adoption Over Time')
plt.xlabel('Model Year')
plt.ylabel('Number of Vehicles Registered')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```


EV Adoption Over Time
Number of Vehicles Registered
60000
50000
40000
30000
20000
10000
0
1997
1998
1999
2000
2002
2003
2008
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Model Year

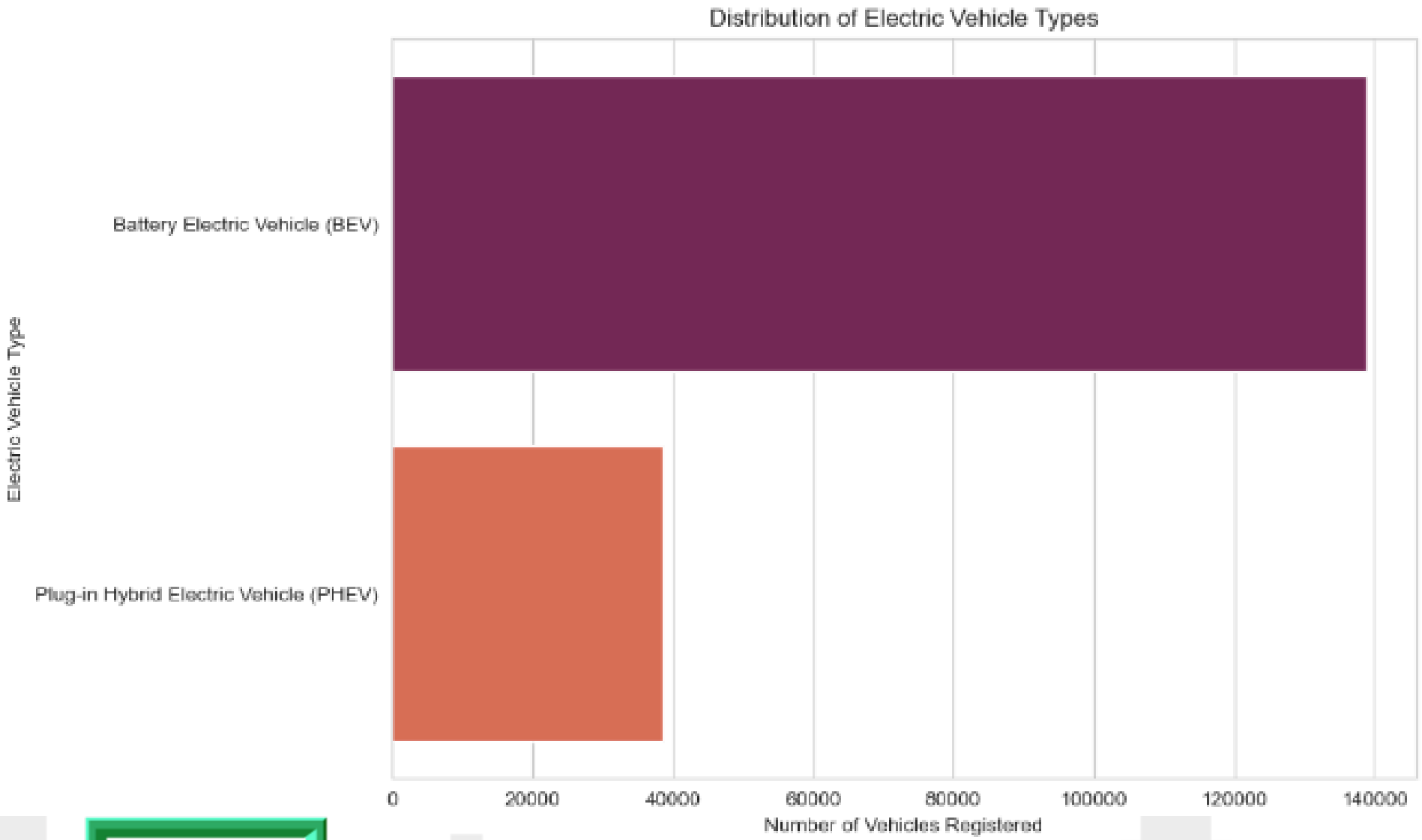

CHARGING

```python
# geographical distribution at county level

ev_county_distribution = ev_data['County'].value_counts()
top_counties = ev_county_distribution.head(3).index


# filtering the dataset for these top counties
top_counties_data = ev_data[ev_data['County'].isin(top_counties)]


# analyzing the distribution of EVs within the cities of these top counties
ev_city_distribution_top_counties = top_counties_data.groupby(['County', 'City']).size().sort_values(ascending=False).reset_index(name='Number of Vehicl

# visualize the top 10 cities across these counties
top_cities = ev_city_distribution_top_counties.head(10)


plt.figure(figsize=(12, 8))
sns.barplot(x='Number of Vehicles', y='City', hue='County', data=top_cities, palette="magma")
plt.title('Top Cities in Top Counties by EV Registrations')
plt.xlabel('Number of Vehicles Registered')
plt.ylabel('City')
plt.legend(title='County')
plt.tight_layout()

plt.show()
```


Top Cities in Top Counties by EV Registrations
County
King
Snohomish
Pierce
City
Seattle
Bellevue
Redmond
Kirkland
Sammamish
Renton
Bothell
Tacoma
Tukwila
5000
10000
20000
25000
30000

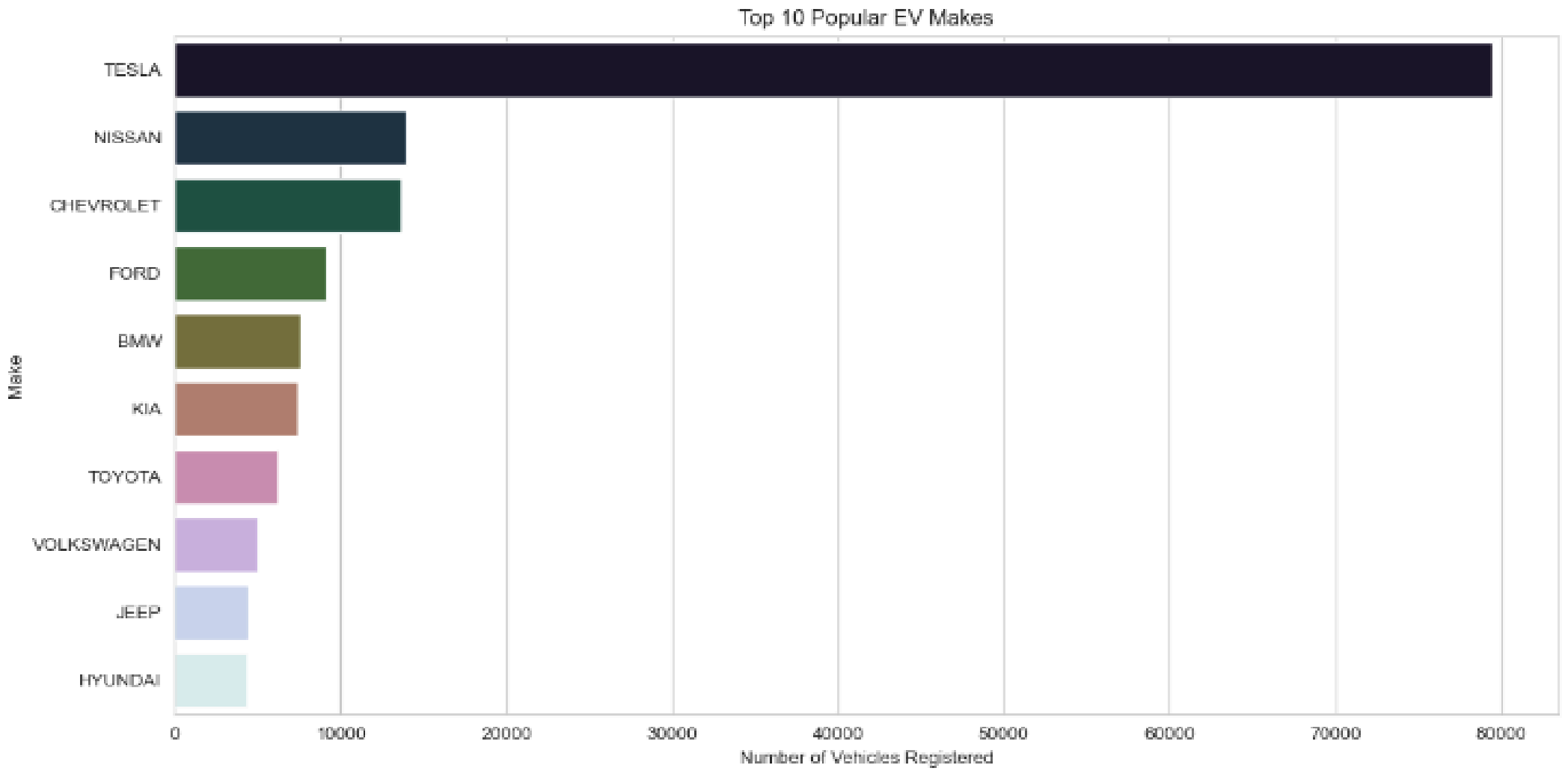

CHARGING

```python
# analyzing the distribution of electric vehicle Types
ev_type_distribution = ev_data['Electric Vehicle Type'].value_counts()



plt.figure(figsize=(10, 6))
sns.barplot(x=ev_type_distribution.values, y=ev_type_distribution.index, palette="rocket")
plt.title('Distribution of Electric Vehicle Types')
plt.xlabel('Number of Vehicles Registered')
plt.ylabel('Electric Vehicle Type')
plt.tight_layout()

plt.show()
```


Distribution of Electric Vehicle Types
Electric Vehicle Type
Battery Electric Vehicle (BEV)
Plug-in Hybrid Electric Vehicle (PHEV)
0
20000
40000
60000
80000
100000
120000
140000
Number of Vehicles Registered

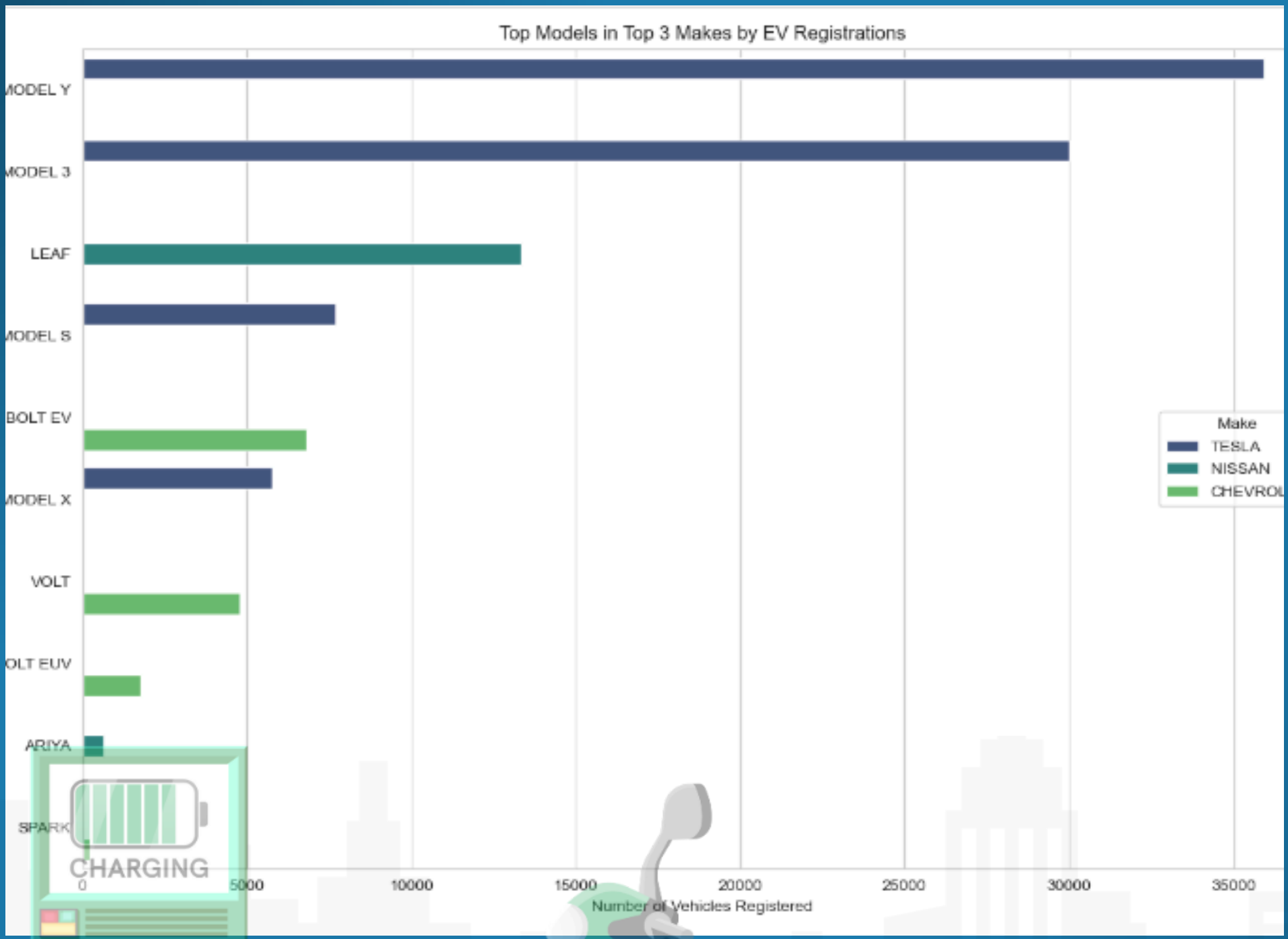

CHARGING

```python
# analyzing the popularity of EV manufacturers
ev_make_distribution = ev_data['Make'].value_counts().head(10)  # Limiting to top 10 for clarity


plt.figure(figsize=(12, 6))
sns.barplot(x=ev_make_distribution.values, y=ev_make_distribution.index, palette="cubehelix")
plt.title('Top 10 Popular EV Makes')
plt.xlabel('Number of Vehicles Registered')
plt.ylabel('Make')

plt.tight_layout()
plt.show()
```

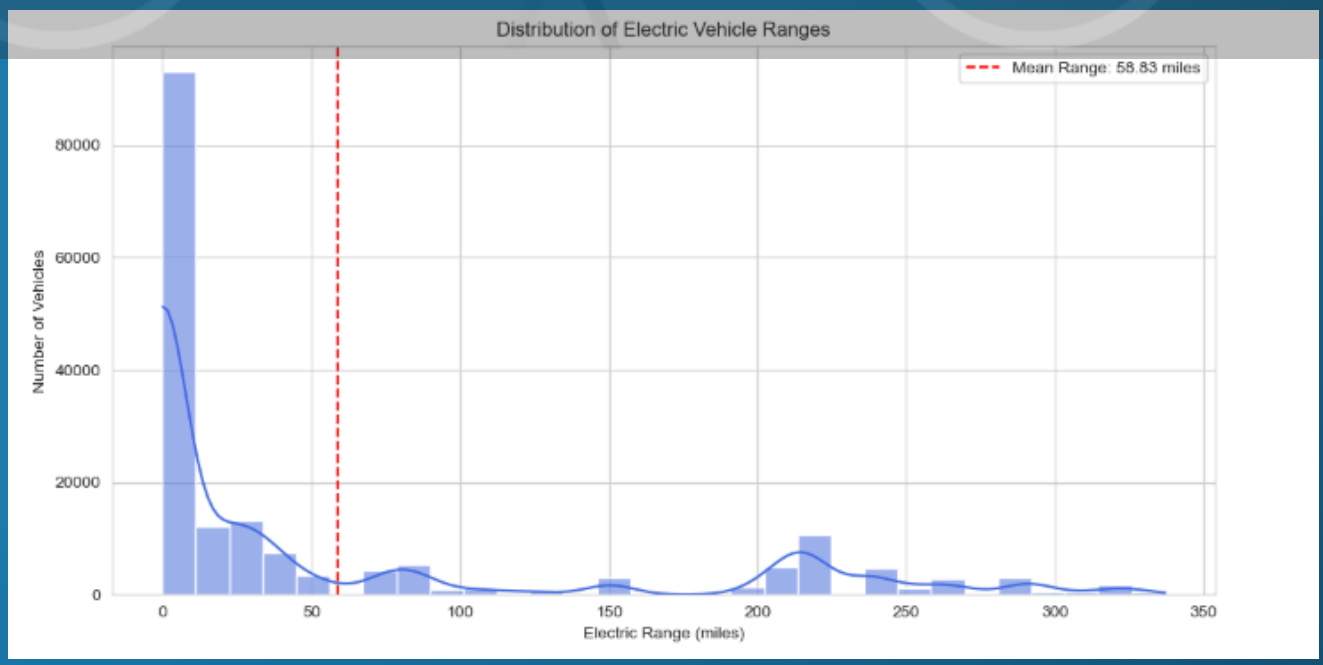

Top 10 Popular EV Makes
TESLA
NISSAN
CHEVROLET
FORD
BMW
KIA
TOYOTA
VOLKSWAGEN
JEEP
HYUNDAI
Make
0
10000
20000
30000
40000
50000
60000
70000
80000
Number of Vehicles Registered


CHARGING

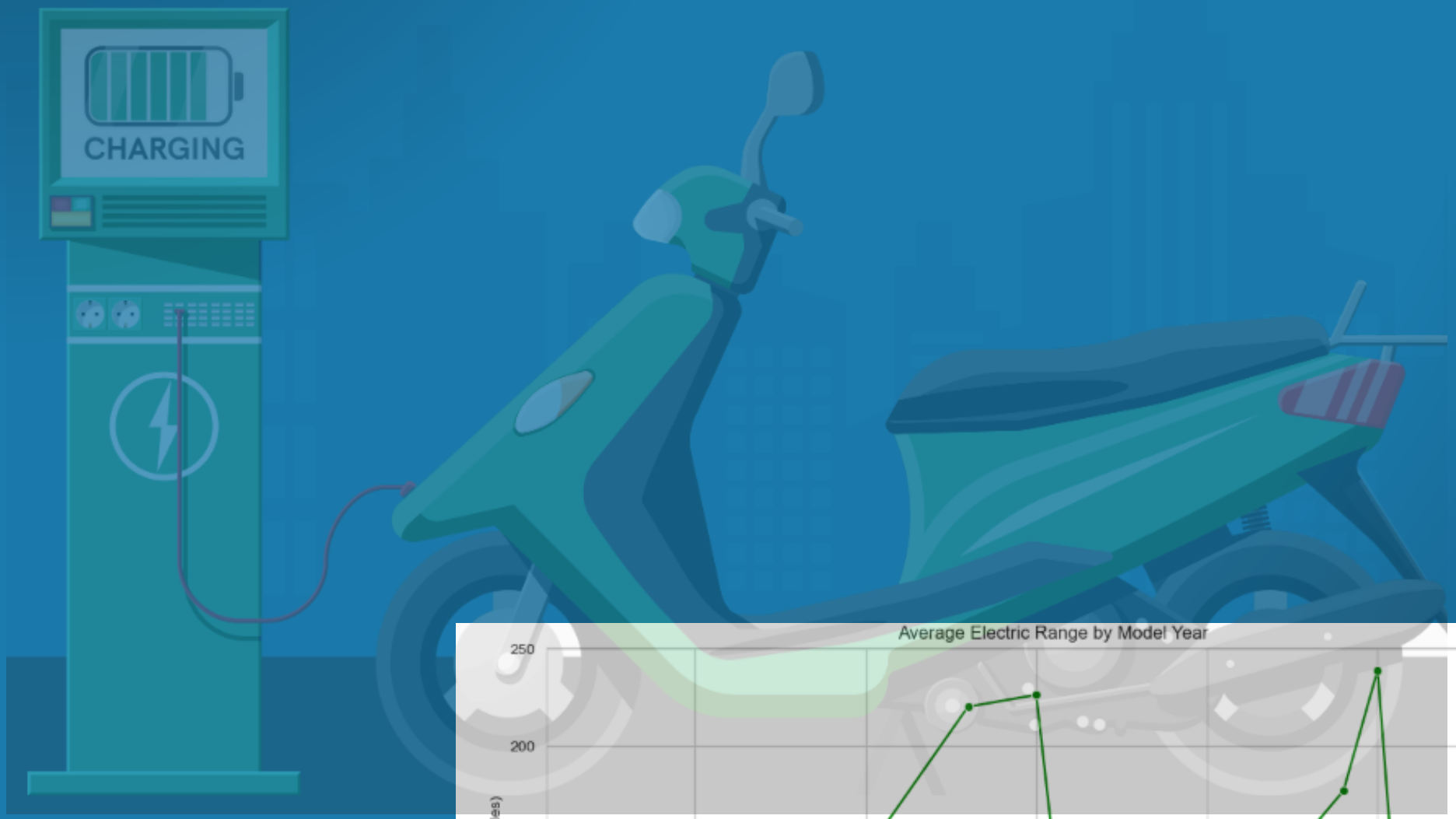
```python
# selecting the top 3 manufacturers based on the number of vehicles registered
top_3_makes = ev_make_distribution.head(3).index


# filtering the dataset for these top manufacturers
top_makes_data = ev_data[ev_data['Make'].isin(top_3_makes)]


# analyzing the popularity of EV models within these top manufacturers
ev_model_distribution_top_makes = top_makes_data.groupby(['Make', 'Model']).size().sort_values(ascending=False).reset_index(name='Number of Vehicles')


# visualizing the top 10 models across these manufacturers for clarity
top_models = ev_model_distribution_top_makes.head(10)


plt.figure(figsize=(12, 8))
sns.barplot(x='Number of Vehicles', y='Model', hue='Make', data=top_models, palette="viridis")
plt.title('Top Models in Top 3 Makes by EV Registrations')
plt.xlabel('Number of Vehicles Registered')
plt.ylabel('Model')
plt.legend(title='Make', loc='center right')

plt.tight_layout()
plt.show()
```

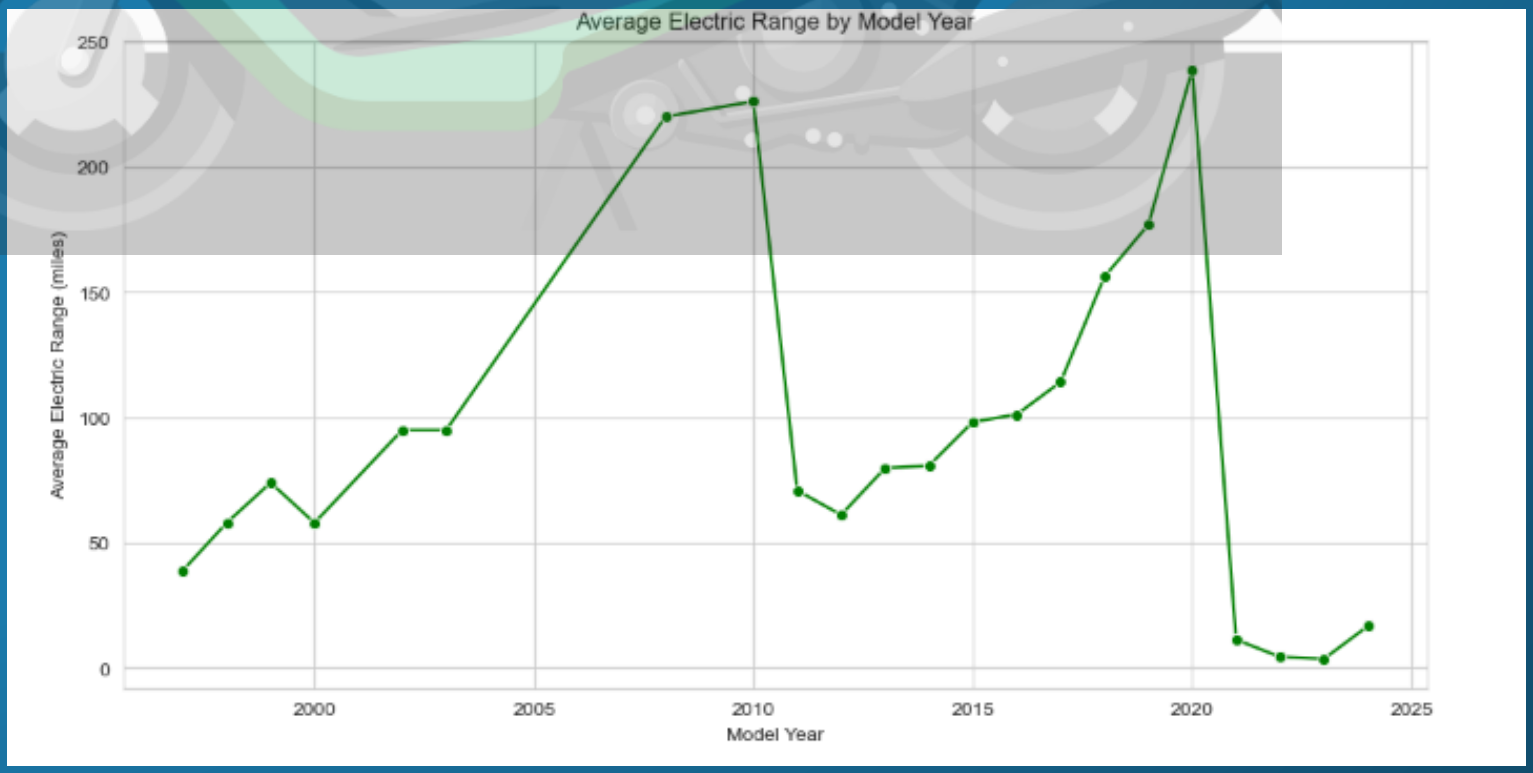

Top Models in Top 3 Makes by EV Registrations
MODEL Y
MODEL 3
LEAF
MODEL S
BOLT EV
MODEL X
VOLT
OLT EUV
ARIYA
SPARK
Make
TESLA
NISSAN
CHEVROL
0
5000
10000
15000
20000
25000
30000
35000
Number of Vehicles Registered

```python
# analyzing the distribution of electric range
plt.figure(figsize=(12, 6))
sns.histplot(ev_data['Electric Range'], bins=30, kde=True, color='royalblue')
plt.title('Distribution of Electric Vehicle Ranges')
plt.xlabel('Electric Range (miles)')
plt.ylabel('Number of Vehicles')
plt.axvline(ev_data['Electric Range'].mean(), color='red', linestyle='--', label=f'Mean Range: {ev_data["Electric Range"].mean():
plt.legend()
plt.show()
```

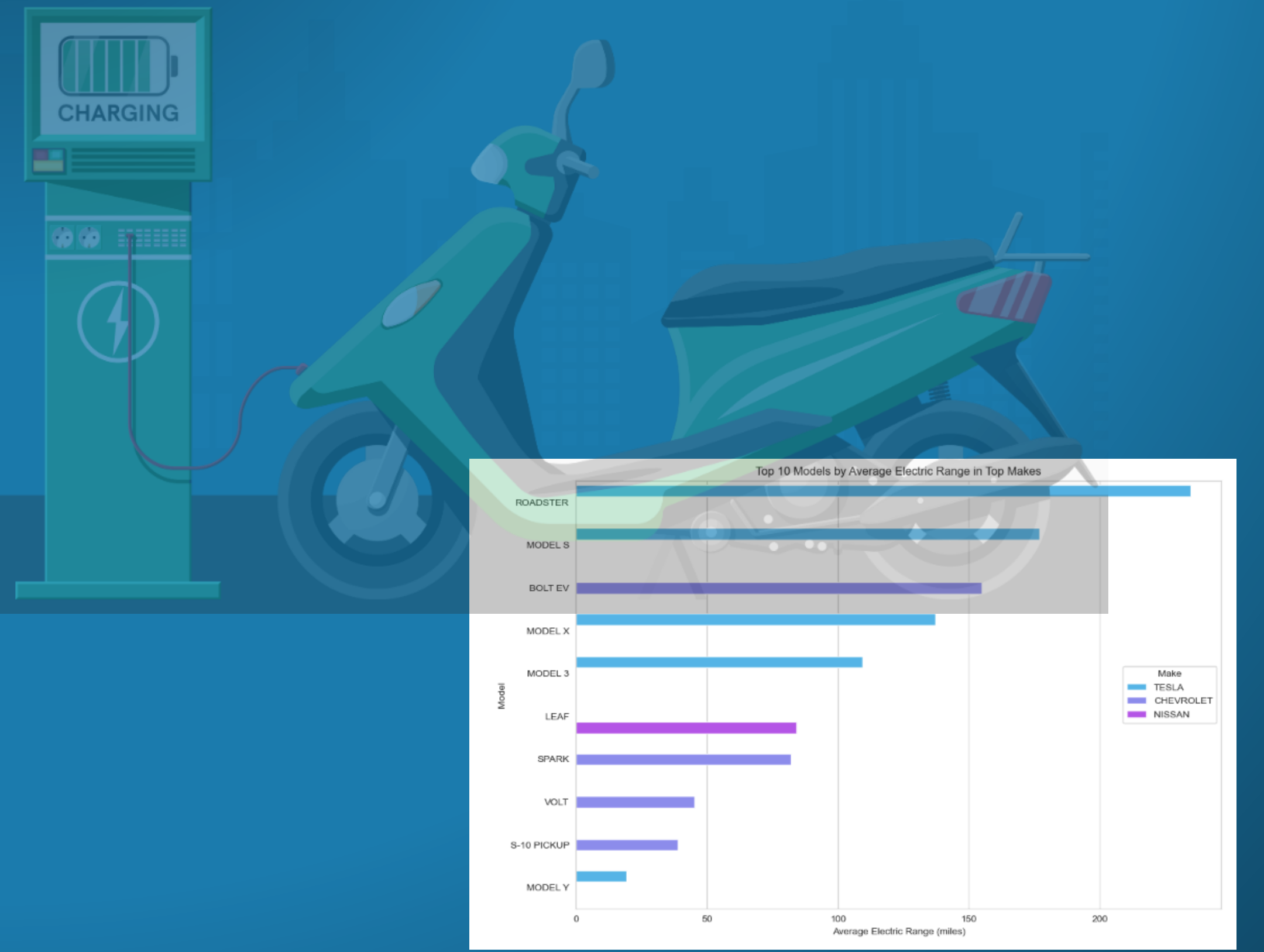


```python
# calculating the average electric range by model year
average_range_by_year = ev_data.groupby('Model Year')['Electric Range'].mean().reset_index()


plt.figure(figsize=(12, 6))
sns.lineplot(x='Model Year', y='Electric Range', data=average_range_by_year, marker='o', color='green')
plt.title('Average Electric Range by Model Year')
plt.xlabel('Model Year')
plt.ylabel('Average Electric Range (miles)')
plt.grid(True)

plt.show()
```





```python
average_range_by_model = top_makes_data.groupby(['Make', 'Model'])['Electric Range'].mean().sort_values(ascending=False).reset_index()

# the top 10 models with the highest average electric range
top_range_models = average_range_by_model.head(10)

plt.figure(figsize=(12, 8))
barplot = sns.barplot(x='Electric Range', y='Model', hue='Make', data=top_range_models, palette="cool")
plt.title('Top 10 Models by Average Electric Range in Top Makes')
plt.xlabel('Average Electric Range (miles)')
plt.ylabel('Model')
plt.legend(title='Make', loc='center right')

plt.show()
```



Estimated Market Size Analysis of Electric Vehicles in the United States

```
# Now, let's move forward towards finding the estimated market size of electric vehicles in the United States.
# I'll first count the number of EVs registered every year:


# calculate the number of EVs registered each year

ev_registration_counts = ev_data['Model Year'].value_counts().sort_index()

ev_registration_counts
```

```
Model Year
1997        1
1998        1
1999        5
2000        7
2002        2
2003        1
2008       19
2010       23
2011      775
2012     1614
2013     4399
2014     3496
2015     4826
2016     5469
2017     8534
2018    14286
2019    10913
2020    11740
2021    19063
2022    27708
2023    57519
2024     7072
Name: count, dtype: int64
```

THANK YOU