In [1]:

```python
# Load libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [2]:

```python
# Load dataset
dataset = pd.read_csv("Electric_Vehicle_Population_Data.csv")
```

In [3]:

```python
# Display first 5 rows
dataset.head()
```

Out[3]:

	vin_prefix	county	city	state	postal_code	model_year	make	model	ele
0	3C3CFFGE1G	Yakima	Yakima	WA	98908.0	2016	FIAT	500	
1	WP0AB2Y16L	King	Auburn	WA	98092.0	2020	PORSCHE	TAYCAN	
2	5YJ3E1EB2J	King	Seattle	WA	98109.0	2018	TESLA	MODEL 3	
3	5YJYGDEF5L	King	Seattle	WA	98125.0	2020	TESLA	MODEL Y	
4	5YJXCBE22J	Thurston	Olympia	WA	98501.0	2018	TESLA	MODEL X	

In [4]:

```python
# Checking information
dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 269673 entries, 0 to 269672
Data columns (total 17 columns):
 #   Column                 Non-Null Count   Dtype  
---  ------                 --------------   -----  
 0   vin_prefix             269673 non-null  object 
 1   county                 269662 non-null  object 
 2   city                   269662 non-null  object 
 3   state                  269673 non-null  object 
 4   postal_code            269662 non-null  float64
 5   model_year             269673 non-null  int64  
 6   make                   269673 non-null  object 
 7   model                  269673 non-null  object 
 8   electric_vehicle_type  269673 non-null  object 
 9   cafv_eligibility       269673 non-null  object 
 10  electric_range         269669 non-null  float64
 11  base_msrp              269669 non-null  float64
 12  legislative_district   269009 non-null  float64
 13  dol_vehicle ID         269673 non-null  int64  
 14  vehicle_location       269584 non-null  object 
 15  electric_utility       269662 non-null  object 
 16  2020_census_tract      269662 non-null  float64
dtypes: float64(5), int64(2), object(10)
memory usage: 35.0+ MB
```

In [4]:

```
dataset.describe()
```

Out[4]:

	postal_code	model_year	electric_range	base_msrp	legislative_district	d
count	269662.000000	269673.000000	269669.000000	269669.000000	269009.000000	2.69
mean	98174.302260	2021.925832	40.751692	663.101079	28.851436	2.43
std	2590.609215	3.050066	79.604176	6790.627969	14.894449	6.46
min	1030.000000	1999.000000	0.000000	0.000000	1.000000	4.38
25%	98052.000000	2021.000000	0.000000	0.000000	17.000000	2.19
50%	98133.000000	2023.000000	0.000000	0.000000	32.000000	2.61
75%	98382.000000	2024.000000	33.000000	0.000000	42.000000	2.76
max	99577.000000	2026.000000	337.000000	845000.000000	49.000000	4.79

Data Cleaning

In [5]:

```
# Checking for missing values
dataset.isnull().sum()
```

Out[5]:

```
vin_prefix                0
county                   11
city                     11
state                     0
postal_code              11
model_year                0
make                      0
model                     0
electric_vehicle_type     0
cafv_eligibility          0
electric_range            4
base_msrp                 4
legislative_district    664
dol_vehicle ID            0
vehicle_location         89
electric_utility         11
2020_census_tract        11
dtype: int64
```

In [6]:

```
df_clean = dataset.copy() # copied dataset
```

In [7]:

```
# Dropping thevalues for 'county', 'city', 'postal_code'
df_clean = df_clean.dropna(subset=['county', 'city', 'postal_code', 'legislative_di
df_clean.head(2)
```

Out[7]:

	vin_prefix	county	city	state	postal_code	model_year	make	model	electı
0	3C3CFFGE1G	Yakima	Yakima	WA	98908.0	2016	FIAT	500	
1	WP0AB2Y16L	King	Auburn	WA	98092.0	2020	PORSCHE	TAYCAN	

In [8]:

```
df_clean.isnull().sum()
```

Out[8]:

```
vin_prefix               0
county                   0
city                     0
state                    0
postal_code              0
model_year               0
make                     0
model                    0
electric_vehicle_type    0
cafv_eligibility         0
electric_range           4
base_msrp                4
legislative_district     0
dol_vehicle ID           0
vehicle_location         0
electric_utility         0
2020_census_tract        0
dtype: int64
```

In [9]:

```
df_clean['electric_range'] = df_clean['electric_range'].fillna(df_clean['electric_r
df_clean['base_msrp'] = df_clean['base_msrp'].fillna(df_clean['base_msrp'].median()
```

In [11]:

```
df_clean.isnull().sum()
```

Out[11]:

```
vin_prefix               0
county                   0
city                     0
state                    0
postal_code              0
model_year               0
make                     0
model                    0
electric_vehicle_type    0
cafv_eligibility         0
electric_range           0
base_msrp                0
legislative_district     0
dol_vehicle ID           0
vehicle_location         0
electric_utility         0
2020_census_tract        0
dtype: int64
```

In [12]:

```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 268931 entries, 0 to 269672
Data columns (total 17 columns):
 #   Column                Non-Null Count   Dtype  
---  ------                --------------   -----  
 0   vin_prefix            268931 non-null  object 
 1   county                268931 non-null  object 
 2   city                  268931 non-null  object 
 3   state                 268931 non-null  object 
 4   postal_code           268931 non-null  float64
 5   model_year            268931 non-null  int64  
 6   make                  268931 non-null  object 
 7   model                 268931 non-null  object 
 8   electric_vehicle_type 268931 non-null  object 
 9   cafv_eligibility      268931 non-null  object 
 10  electric_range        268931 non-null  float64
 11  base_msrp             268931 non-null  float64
 12  legislative_district  268931 non-null  float64
 13  dol_vehicle ID        268931 non-null  int64  
 14  vehicle_location      268931 non-null  object 
 15  electric_utility      268931 non-null  object 
 16  2020_census_tract     268931 non-null  float64
dtypes: float64(5), int64(2), object(10)
memory usage: 36.9+ MB
```

Changing data types

In [13]:

```
df_clean['postal_code'] = df_clean['postal_code'].astype(int)                  #
df_clean['legislative_district'] = df_clean['legislative_district'].astype(int)   #
df_clean['2020_census_tract'] = df_clean['2020_census_tract'].astype(int)      #
```

In [14]:

```
df_clean.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 268931 entries, 0 to 269672
Data columns (total 17 columns):
 #   Column                 Non-Null Count   Dtype  
---  ------                 --------------   -----  
 0   vin_prefix             268931 non-null  object 
 1   county                 268931 non-null  object 
 2   city                   268931 non-null  object 
 3   state                  268931 non-null  object 
 4   postal_code            268931 non-null  int64  
 5   model_year             268931 non-null  int64  
 6   make                   268931 non-null  object 
 7   model                  268931 non-null  object 
 8   electric_vehicle_type  268931 non-null  object 
 9   cafv_eligibility       268931 non-null  object 
 10  electric_range         268931 non-null  float64
 11  base_msrp              268931 non-null  float64
 12  legislative_district   268931 non-null  int64  
 13  dol_vehicle ID         268931 non-null  int64  
 14  vehicle_location       268931 non-null  object 
 15  electric_utility       268931 non-null  object 
 16  2020_census_tract      268931 non-null  int64  
dtypes: float64(2), int64(5), object(10)
memory usage: 36.9+ MB
```

In [15]:

```python
df_clean['cafv_eligibility'].unique()
```

Out[15]:

```
array(['Clean Alternative Fuel Vehicle Eligible',
       'Eligibility unknown as battery range has not been researched',
       'Not eligible due to low battery range'], dtype=object)
```

In [16]:

```python
df_clean['cafv_eligibility'] = df_clean['cafv_eligibility'].replace({
        'Clean Alternative Fuel Vehicle Eligible' : 'Eligible',
        'Eligibility unknown as battery range has not been researched' : 'Unknown',
        'Not eligible due to low battery range' : 'Not_Eligible'
})
```

In [17]:

```python
df_clean.head(2)
```

Out[17]:

	vin_prefix	county	city	state	postal_code	model_year	make	model	electi
0	3C3CFFGE1G	Yakima	Yakima	WA	98908	2016	FIAT	500	
1	WP0AB2Y16L	King	Auburn	WA	98092	2020	PORSCHE	TAYCAN	

In [18]:

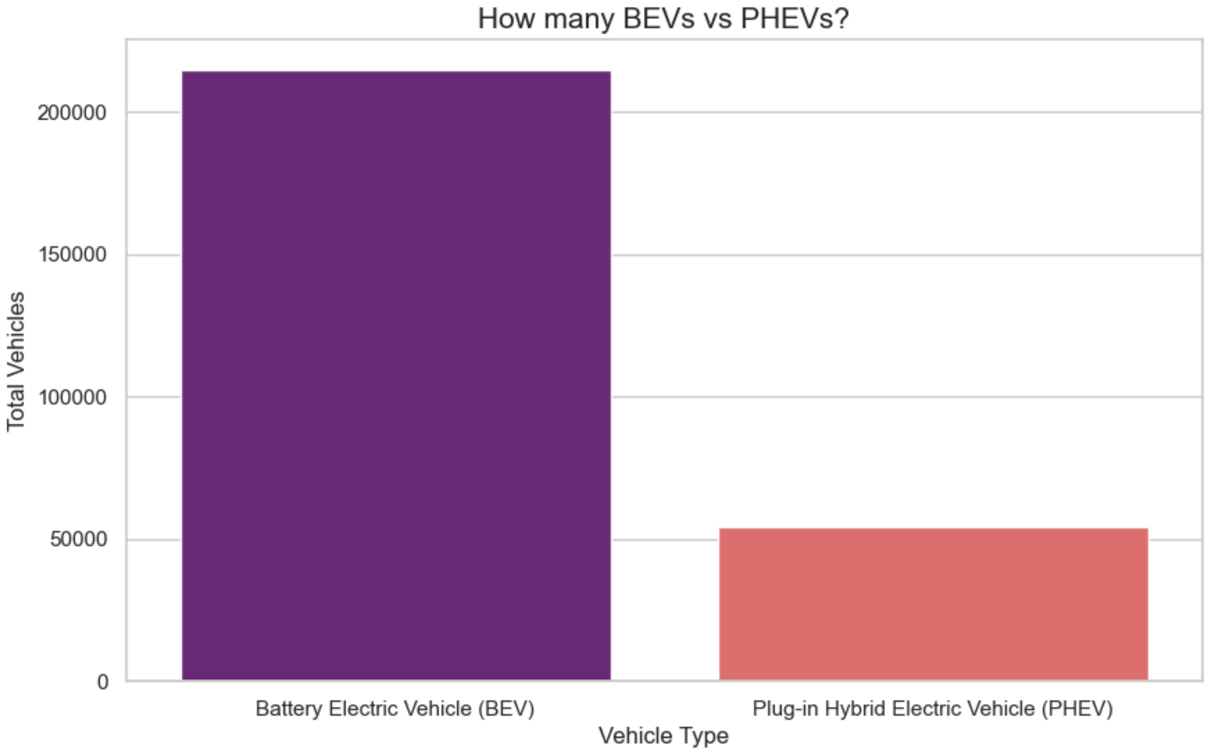
```
df_clean.to_csv("EV_cleaned.csv", index = False)
```

EDA

In [19]:

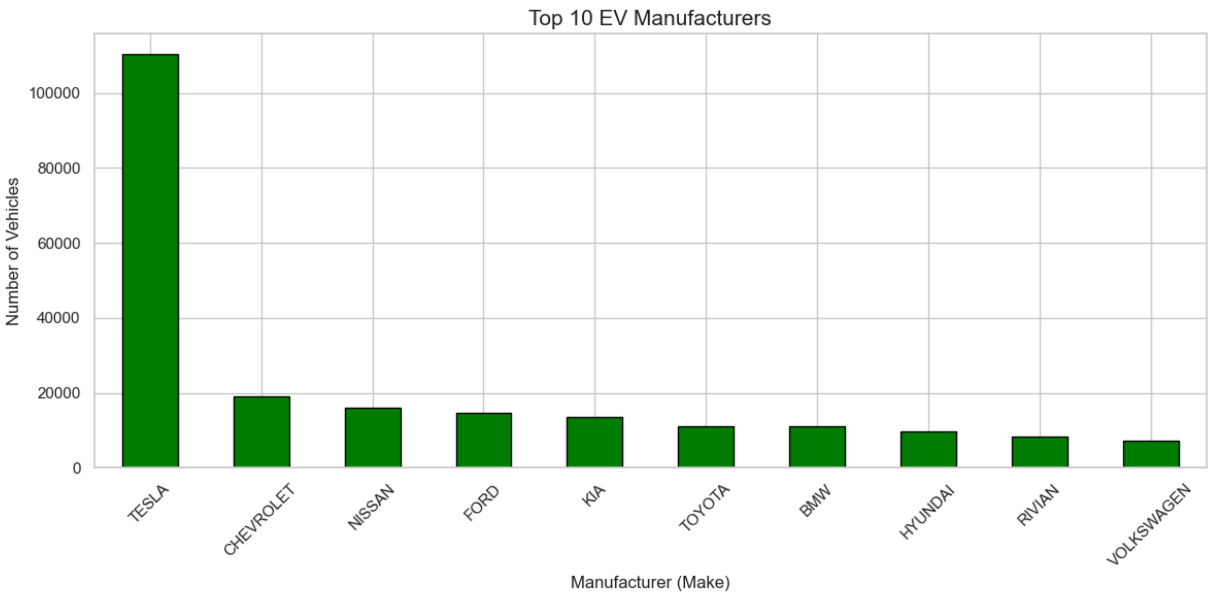
```
# Battery EV vs Hybrid
sns.set_theme(style="whitegrid")
plt.figure(figsize=(10, 6))
sns.countplot(data=df_clean, x='electric_vehicle_type', palette='magma')
plt.title('How many BEVs vs PHEVs?', fontsize=15)
plt.xlabel('Vehicle Type', fontsize=12)
plt.ylabel('Total Vehicles', fontsize=12)

plt.show()
```

```
C:\Users\ardy1\AppData\Local\Temp\ipykernel_6296\1442390787.py:4: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.1
4.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect.

  sns.countplot(data=df_clean, x='electric_vehicle_type', palette='magma')
```



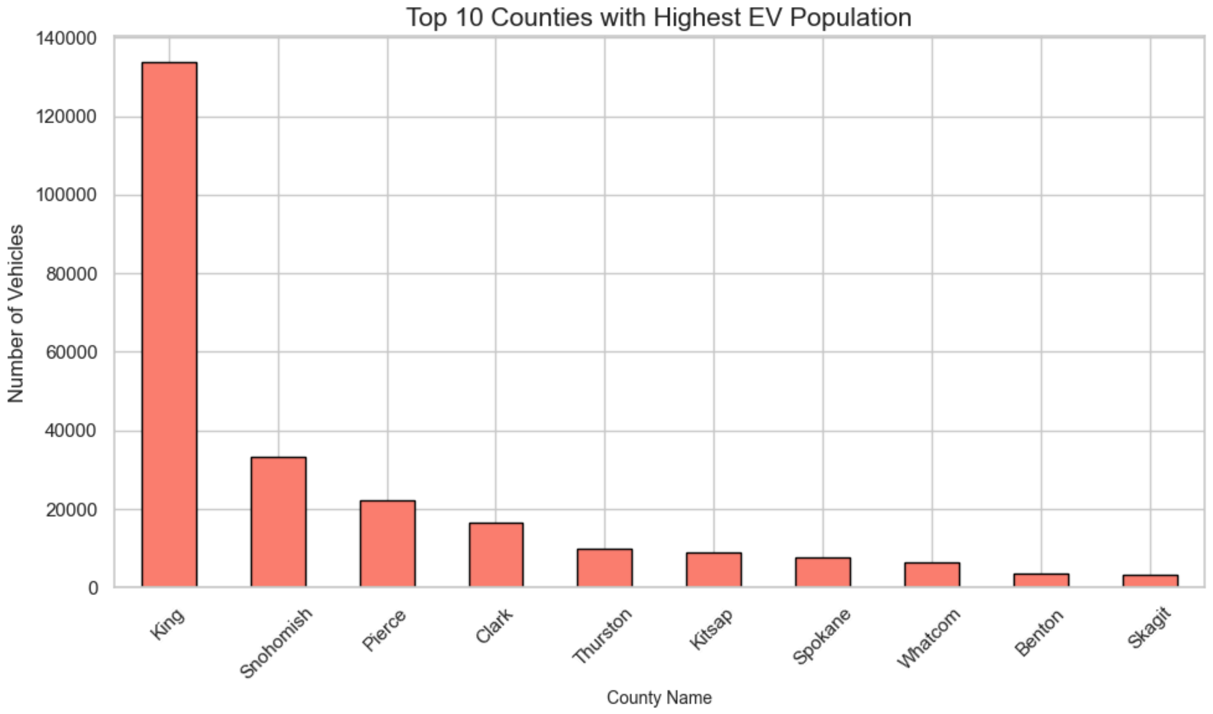
In [20]:

```
# Top 10 EV Manufacturers
top_10_makes = df_clean['make'].value_counts().head(10)
plt.figure(figsize=(12, 6))
top_10_makes.plot(kind='bar', color='green', edgecolor='black')
plt.title('Top 10 EV Manufacturers', fontsize=15)
plt.xlabel('Manufacturer (Make)', fontsize=12)
plt.ylabel('Number of Vehicles', fontsize=12)
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [21]:

```
# Top 10 Counties
top_10_counties = df_clean['county'].value_counts().head(10)
plt.figure(figsize = (10,6))
top_10_counties.plot(kind = 'bar', color = 'salmon', edgecolor = 'black')
plt.title('Top 10 Counties with Highest EV Population', fontsize = 15)
plt.xlabel('County Name', fontsize = 10)
plt.ylabel('Number of Vehicles', fontsize = 12)
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [ ]:

In [ ]:

```
In [ ]:
```

```
In [ ]:
```

```
In [ ]:
```

```
In [ ]:
```

```
In [ ]:
```