
# Data Visualization Project

Electric Vehicles (EVs)

José Ramírez

# EVs Project Description

In this project, our primary focus revolves around addressing a series of analytical questions related to the use of electric vehicles (EVs) over the past five years. We have at our disposal two main datasets: the first one provides us with a comprehensive EV census spanning from 2018 to 2022 in the United States, while the second dataset offers an in-depth insight into the technical specifications and pricing information of the most popular EV models.

Our primary goal is to put into practice the skills acquired in our classroom through the creation of insightful visualizations and present our findings as the solutions to these analytical inquiries. This project aims to not only enhance our understanding of the EV landscape but also contribute valuable insights to this dynamic and evolving sector.

# Original Data Sets

The original datasets can be found at the following links.

- Dataset No. 1: "*Electric_Vehicle_Population_Data.cvs*": https://catalog.data.gov/dataset/electric-vehicle-population-data
- Dataset No. 2: "*ElectricCarData_Clean_Me.cvs*": https://www.kaggle.com/datasets/divyanshugupta95/cars-dataset-with-battery-pack-capacity
- Dataset No. 3: "euro-daily-hist_1999_2022.cvs: https://www.kaggle.com/datasets/lsind18/euro-exchange-daily-rates-19992020/data

# Data Dictionary

1. **EV_Type:** define if the car model is a Battery Electric Vehicle (BEV) or Plug-in Hybrid Electric Vehicle (PHEV).
2. **Brand:** name if the manufacturer of the vehicle.
3. **Model:** model name.
4. **Accel_Sec:** acceleration as 0-100 km/h.
5. **Top_Speed:** is the top speed in km/h.
6. **Range_Km:** is the range in km.
7. **Efficiency_WhKm:** amount of electrical energy consumed to travel 1 Km.
8. **Rapid_Charge:** indicate whether the EVs have rapid charge.
9. **Fast Charge:** charge km/h.
10. **Power_Train:** front, rear, or all-wheel drive.
11. **Plug_Type:** plug type.
12. **Body_Style:** basic size or style.
13. **Battery_Pack_Kwh:** Refers to the total amount of electrical energy a battery pack can store. It's measured in units like kilowatt-hours (kWh).
14. **Seats:** number of seats.
15. **Price:** average price in euros for the last 5 years.

# Analysis Questions

1. Are people using more EVs in recent years?
2. Which states had more EVs?
3. Which county held the highest number of EVs?
4. Which manufacturer had the majority of EVs?
5. Which style of EVs do people tend to gravitate towards?
6. Which manufacturer had the highest battery pack capacity?
7. Which manufacturer had the highest efficiency?
8. Which manufacturer had the lowest acceleration?
9. Which manufacturer had the highest top speed?
10. Are specific features of EVs linked to their pricing?

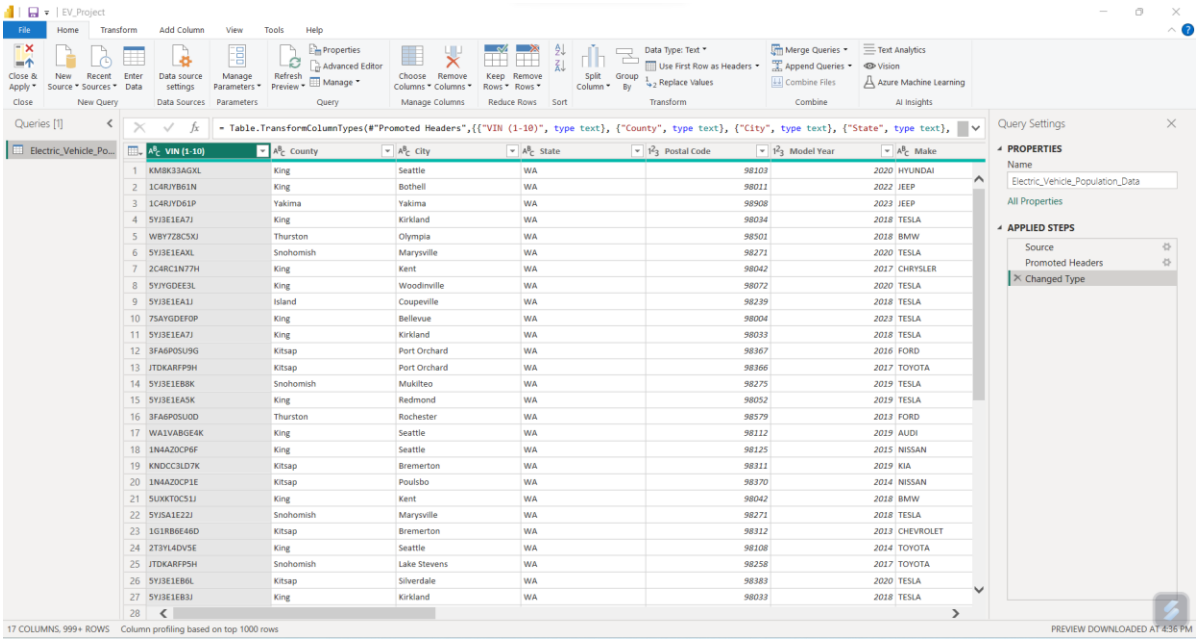
# Part A

## Data transformation in Power BI

### Cleaning

#### *Dataset No. 1: "Electric_Vehicle_Population_Data.cvs"*

**Initial screenshot**




→ Renamed the query to: Electric_Vehicle_Census.

→ Removed the following columns:

'VIN (1-10)',
'Clean Alternative Fuel Vehicle (CAFV) Eligibility',
'Base MSRP',
'Legislative District',
'DOL Vehicle ID',
'2020 Census Tract'

'Electric Utility'

→ Split longitude and latitude from the 'Vehicle Location' column.

→ Renamed columns:

'Postal Code': 'Postal_Code',
'Model Year': 'Model_Year',
'Make': 'Brand',
'Electric Vehicle Type': 'EV_Type',
'Electric Range': 'Range_Km'

→ Removed blank rows.

→ Based on the column “Model_Year”, created a new “*column for example*” called Sales_Year.

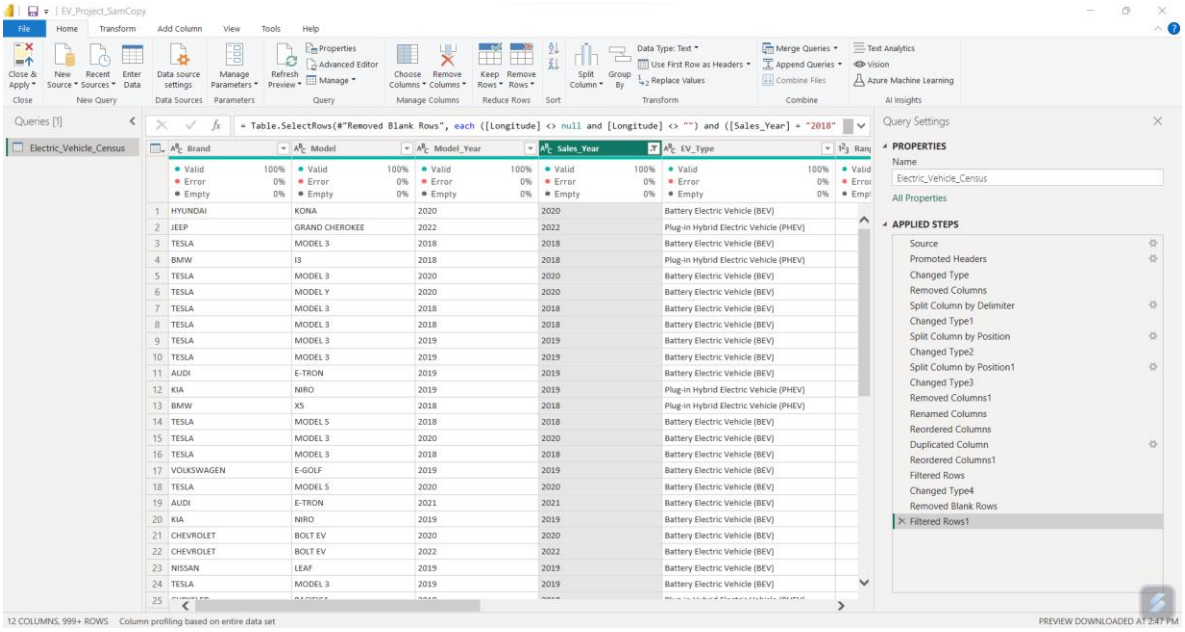
→ Reorder Columns:

Brand,
Model,
Model_Year,
Sales_Year,
EV_Type,
Range_Km,
County,
City,
Postal_Code,
State,
Longitude,
Latitude.

→ Changed data types.

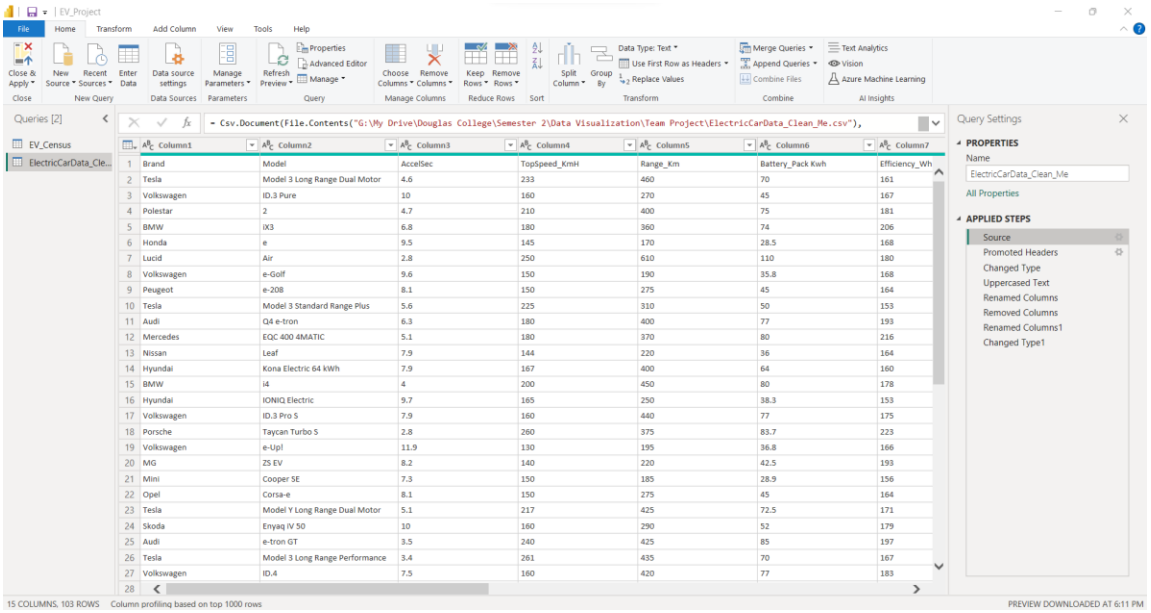
→ Filtered Sales_Year only from 2018 to 2022.

**Final screenshot**



## *Dataset No. 2: "ElectricCarData_Clean_Me.cvs"*

**Initial screenshot**



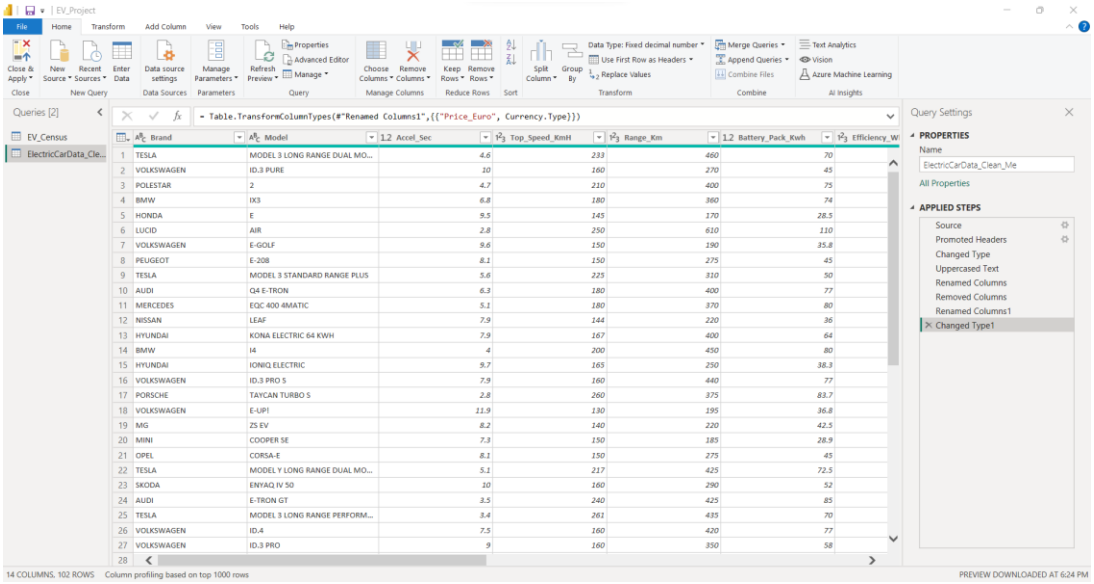
| | Column1 | Column2 | Column3 | Column4 | Column5 | Column6 | Column7 |
|---|---|---|---|---|---|---|---|
| 1 | Brand | Model | AccelSec | TopSpeed_KmH | Range_Km | Battery_Pack Kwh | Efficiency_Wh |
| 2 | Tesla | Model 3 Long Range Dual Motor | 4.6 | 233 | 460 | 70 | 161 |
| 3 | Volkswagen | ID.3 Pure | 10 | 160 | 270 | 45 | 167 |
| 4 | Polestar | 2 | 4.7 | 210 | 400 | 75 | 181 |
| 5 | BMW | iX3 | 6.8 | 180 | 360 | 74 | 206 |
| 6 | Honda | e | 9.5 | 145 | 170 | 28.5 | 168 |
| 7 | Lucid | Air | 2.8 | 250 | 610 | 110 | 180 |
| 8 | Volkswagen | e-Golf | 9.6 | 150 | 190 | 35.8 | 168 |
| 9 | Peugeot | e-208 | 8.1 | 150 | 275 | 45 | 164 |
| 10 | Tesla | Model 3 Standard Range Plus | 5.6 | 225 | 310 | 50 | 153 |
| 11 | Audi | Q4 e-tron | 6.3 | 180 | 400 | 77 | 193 |
| 12 | Mercedes | EQC 400 4MATIC | 5.1 | 180 | 370 | 80 | 216 |
| 13 | Nissan | Leaf | 7.9 | 144 | 220 | 36 | 164 |
| 14 | Hyundai | Kona Electric 64 kWh | 7.9 | 167 | 400 | 64 | 160 |
| 15 | BMW | i4 | 4 | 200 | 450 | 80 | 178 |
| 16 | Hyundai | IONIQ Electric | 9.7 | 165 | 250 | 38.3 | 153 |
| 17 | Volkswagen | ID.3 Pro S | 7.9 | 160 | 440 | 77 | 175 |
| 18 | Porsche | Taycan Turbo S | 2.8 | 260 | 375 | 83.7 | 223 |
| 19 | Volkswagen | e-Up! | 11.9 | 130 | 195 | 36.8 | 166 |
| 20 | MG | ZS EV | 8.2 | 140 | 220 | 42.5 | 193 |
| 21 | Mini | Cooper SE | 7.3 | 150 | 185 | 28.9 | 156 |
| 22 | Opel | Corsa-e | 8.1 | 150 | 275 | 45 | 164 |
| 23 | Tesla | Model Y Long Range Dual Motor | 5.1 | 217 | 425 | 72.5 | 171 |
| 24 | Skoda | Enyaq iV 50 | 10 | 160 | 290 | 52 | 179 |
| 25 | Audi | e-tron GT | 3.5 | 240 | 425 | 85 | 197 |
| 26 | Tesla | Model 3 Long Range Performance | 3.4 | 261 | 435 | 70 | 167 |
| 27 | Volkswagen | ID.4 | 7.5 | 160 | 420 | 77 | 183 |

→ Renamed the query to: ElectricCarData_Prices.
→ Removed the column "Segment".
→ Renamed columns:

```
'AccelSec': 'Accel_Sec',
'TopSpeed_KmH': 'Top_Speed_KmH',
'Battery_Pack Kwh': 'Battery_Pack_Kwh',
'FastCharge_KmH': 'Fast_Charge_KmH',
'RapidCharge': 'Rapid_Charge',
'PowerTrain': 'Power_Train',
'PlugType': 'Plug_Type',
'BodyStyle': 'Body_Style',
'PriceEuro': 'Price_Euro'
```

→ Changed data types.

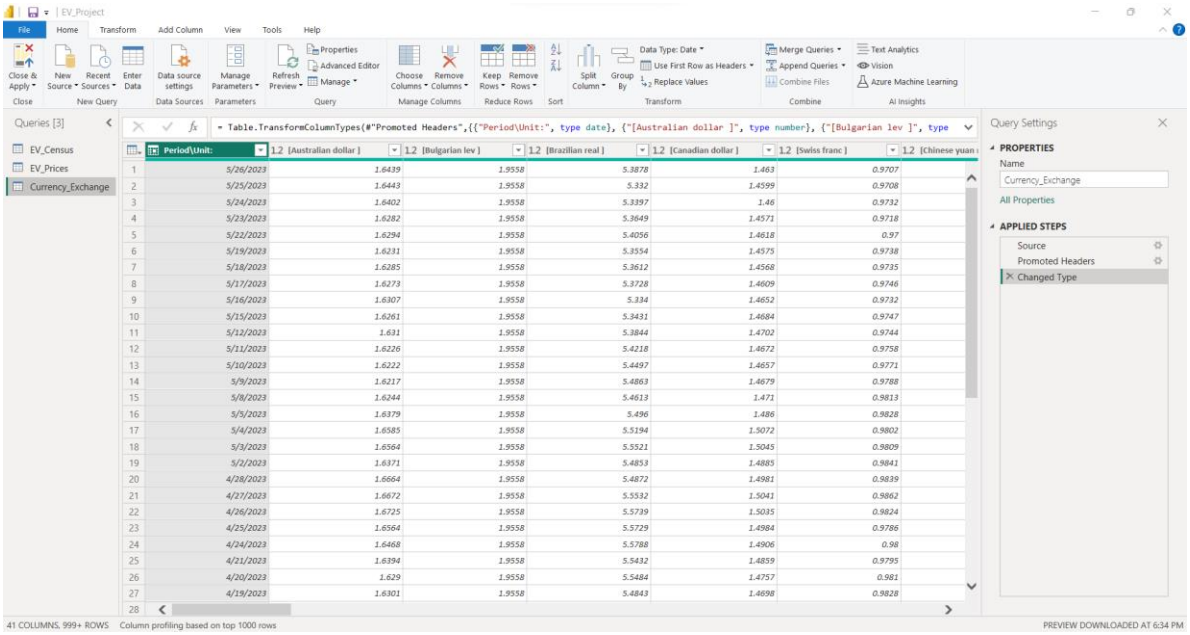
**Final screenshot**



| | Brand | Model | Accel_Sec | Top_Speed_KmH | Range_Km | Battery_Pack_Kwh | Efficiency_W |
|---|---|---|---|---|---|---|---|
| 1 | TESLA | MODEL 3 LONG RANGE DUAL MO... | 4.6 | 233 | 460 | 70 | |
| 2 | VOLKSWAGEN | ID.3 PURE | 10 | 160 | 270 | 45 | |
| 3 | POLESTAR | 2 | 4.7 | 210 | 400 | 75 | |
| 4 | BMW | IX3 | 6.8 | 180 | 360 | 74 | |
| 5 | HONDA | E | 9.5 | 145 | 170 | 28.5 | |
| 6 | LUCID | AIR | 2.8 | 250 | 610 | 110 | |
| 7 | VOLKSWAGEN | E-GOLF | 9.6 | 150 | 190 | 35.8 | |
| 8 | PEUGEOT | E-208 | 8.1 | 150 | 275 | 45 | |
| 9 | TESLA | MODEL 3 STANDARD RANGE PLUS | 5.6 | 225 | 310 | 50 | |
| 10 | AUDI | Q4 E-TRON | 6.3 | 180 | 400 | 77 | |
| 11 | MERCEDES | EQC 400 4MATIC | 5.1 | 180 | 370 | 80 | |
| 12 | NISSAN | LEAF | 7.9 | 144 | 220 | 36 | |
| 13 | HYUNDAI | KONA ELECTRIC 64 KWH | 7.9 | 167 | 400 | 64 | |
| 14 | BMW | I4 | 4 | 200 | 450 | 80 | |
| 15 | HYUNDAI | IONIQ ELECTRIC | 9.7 | 165 | 250 | 38.3 | |
| 16 | VOLKSWAGEN | ID.3 PRO S | 7.9 | 160 | 440 | 77 | |
| 17 | PORSCHE | TAYCAN TURBO S | 2.8 | 260 | 375 | 83.7 | |
| 18 | VOLKSWAGEN | E-UP! | 11.9 | 130 | 195 | 36.8 | |
| 19 | MG | ZS EV | 8.2 | 140 | 220 | 42.5 | |
| 20 | MINI | COOPER SE | 7.3 | 150 | 185 | 28.9 | |
| 21 | OPEL | CORSA-E | 8.1 | 150 | 275 | 45 | |
| 22 | TESLA | MODEL Y LONG RANGE DUAL MO... | 5.1 | 217 | 425 | 72.5 | |
| 23 | SKODA | ENYAQ IV 50 | 10 | 160 | 290 | 52 | |
| 24 | AUDI | E-TRON GT | 3.5 | 240 | 425 | 85 | |
| 25 | TESLA | MODEL 3 LONG RANGE PERFORM... | 3.4 | 261 | 435 | 70 | |
| 26 | VOLKSWAGEN | ID.4 | 7.5 | 160 | 420 | 77 | |
| 27 | VOLKSWAGEN | ID.3 PRO | 9 | 160 | 350 | 58 | |

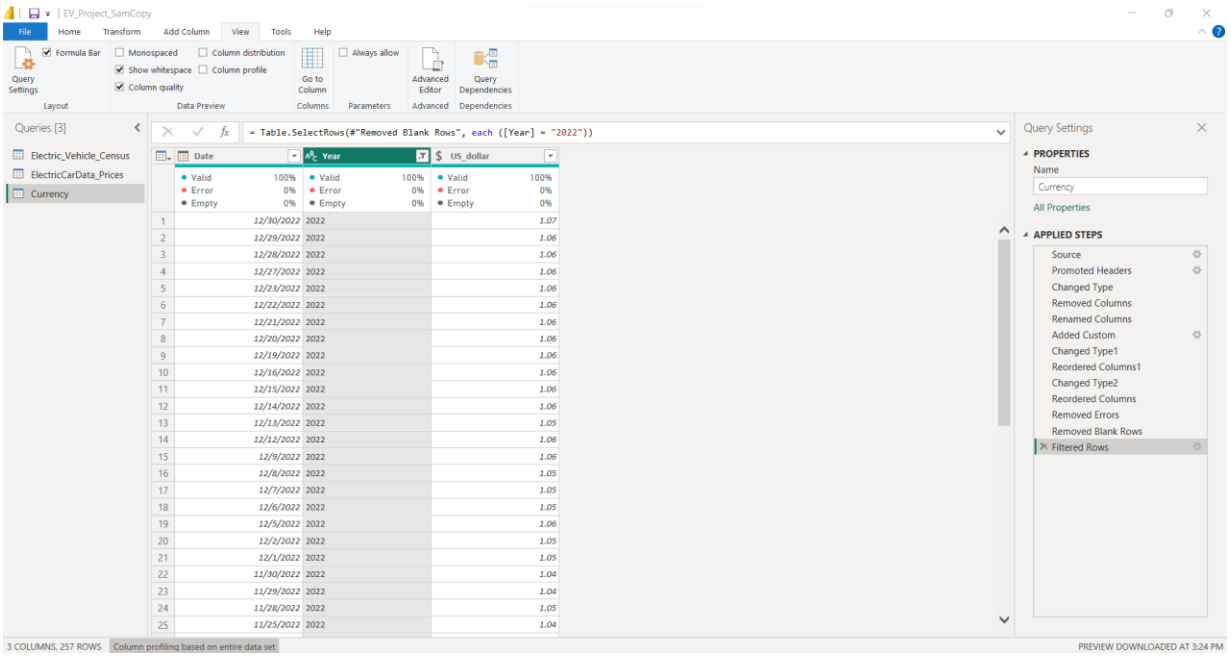
## *Dataset No. 3: "euro-daily-hist_1999_2022.cvs"*

**Initial screenshot**



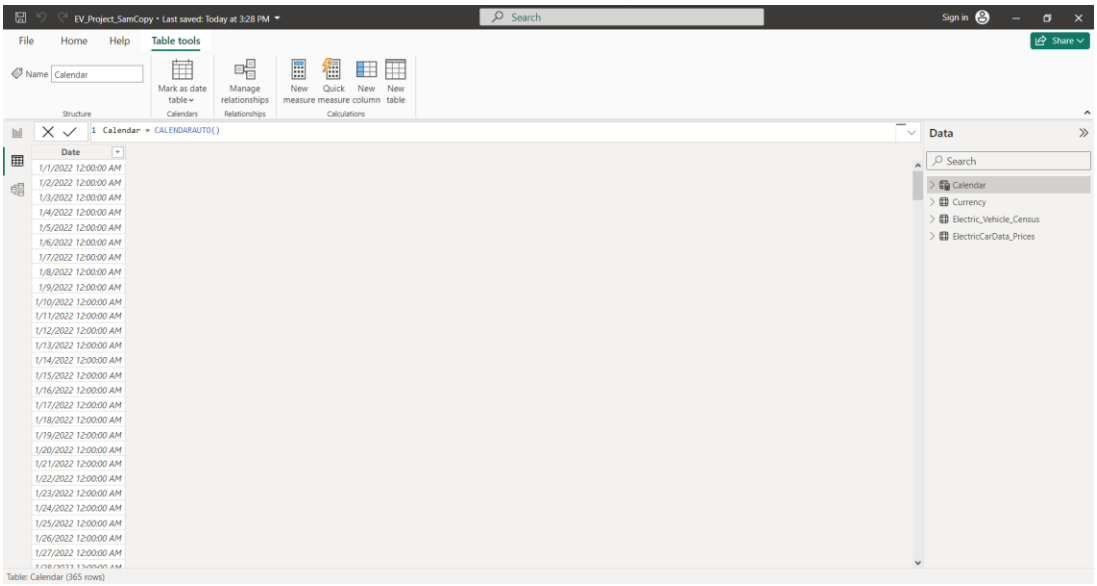
→ Renamed the query to: Currency.
→ Remove all column except from "Period\Unit:", and "[US dollar]".
→ Renamed columns:
' Period\Unit:': 'Date',
' US dollar ': 'US_dollar',
→ Extracted the year from the "Date" column. Created a new "*custom column*" → Used Power Query M formula: Date.Year([Date]).
→ Changed data types.
→ Removed errors.
→ Filtered Year only from 2022.

**Final screenshot**



New Table: Calendar

→ Table view→Home→ New table → DAX: Calendar = CALENDARAUTO()




# Relation Model

To figure out which types of EVs people are into, we used two datasets: “ElectricCarData_Prices”, which tells us about the car's style by brand and model, and “Electric_Vehicle_Census”, which counts the number of these cars by brand and model. **Quick note:** To keep things manageable, we only looked at a handful of brands – Tesla, Nissan, KIA, Ford, Volkswagen, BMW, Audi, and Volvo. This way, we can get a clearer picture of what styles people are going for in their EVs.

→ In the “ElectricCarData_Prices” query, we modified the ‘Model’ column to match the ‘Model’ Column of the “Electric_Vehicle_Census query”. This modification is held in the ‘Model_ID’ Column.

Example: “*Electric_Vehicle_Census” query*

| | Brand | Model | Model_ID |
|---|---|---|---|
| 1 | TESLA | MODEL 3 | MODEL 3 |
| 2 | TESLA | MODEL 3 | MODEL 3 |
| 3 | TESLA | MODEL S | MODEL S |
| 4 | TESLA | MODEL 3 | MODEL 3 |
| 5 | TESLA | MODEL 3 | MODEL 3 |
| 6 | TESLA | MODEL 3 | MODEL 3 |
| 7 | TESLA | MODEL 3 | MODEL 3 |
| 8 | TESLA | MODEL 3 | MODEL 3 |

*“ElectricCarData_Prices” query*

| | Brand | Model | Model_ID |
|---|---|---|---|
| 1 | TESLA | MODEL 3 LONG RANGE DUAL MO... | MODEL 3 |

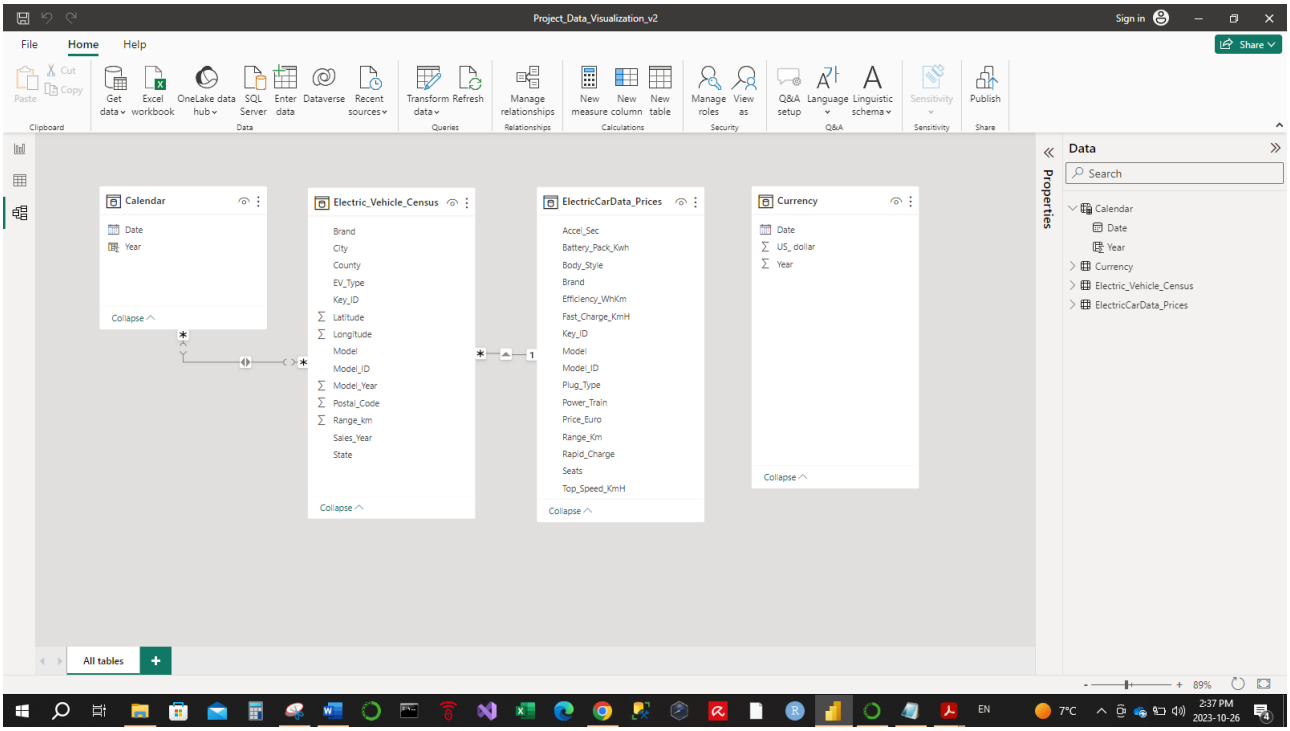
→ Now that we standardized the ‘Model’ car in both queries, we created a primary KEY in both called ‘Key_ID’ which concatenates ‘Brand’ and ‘Model_ID’ columns.

*“Electric_Vehicle_Census” query*

| | Key_ID | Brand | Model | Model_ID |
|---|---|---|---|---|
| 1 | TESLA_MODEL 3 | TESLA | MODEL 3 | MODEL 3 |

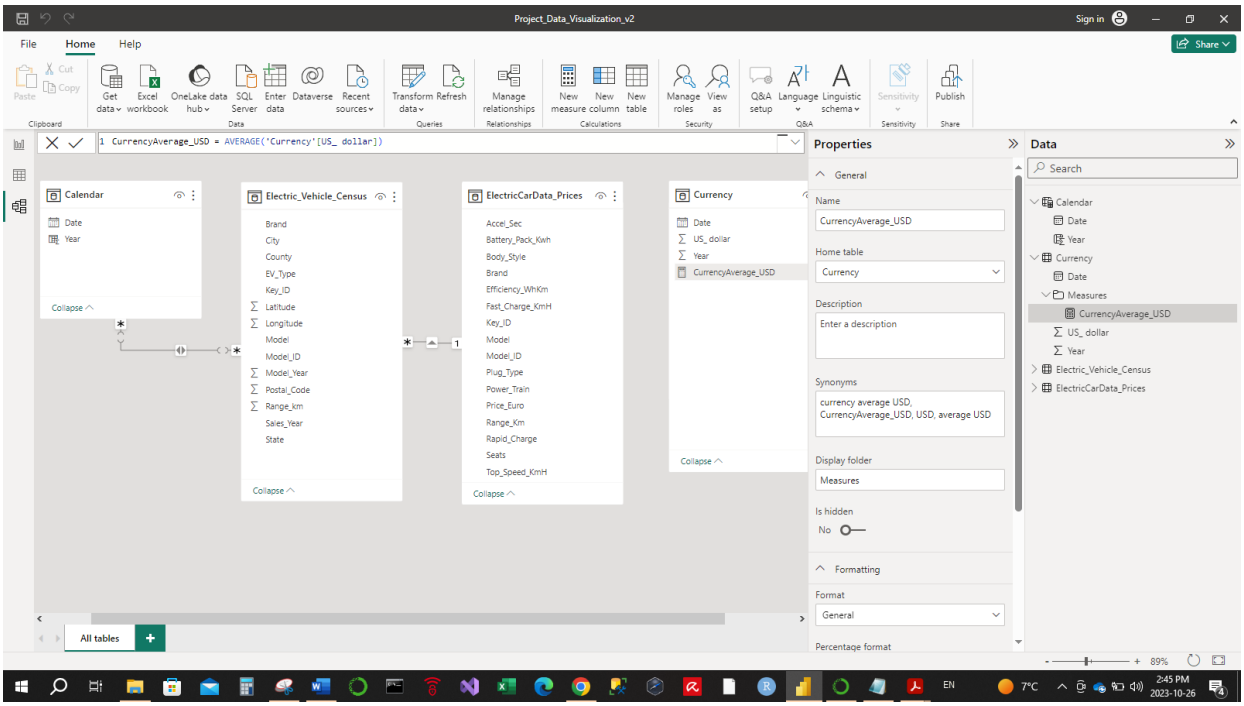
*“ElectricCarData_Prices” query*

| | Key_ID | Brand | Model | Model_ID |
|---|---|---|---|---|
| 1 | TESLA_MODEL 3 | TESLA | MODEL 3 LONG RANGE DUAL MO... | MODEL 3 |



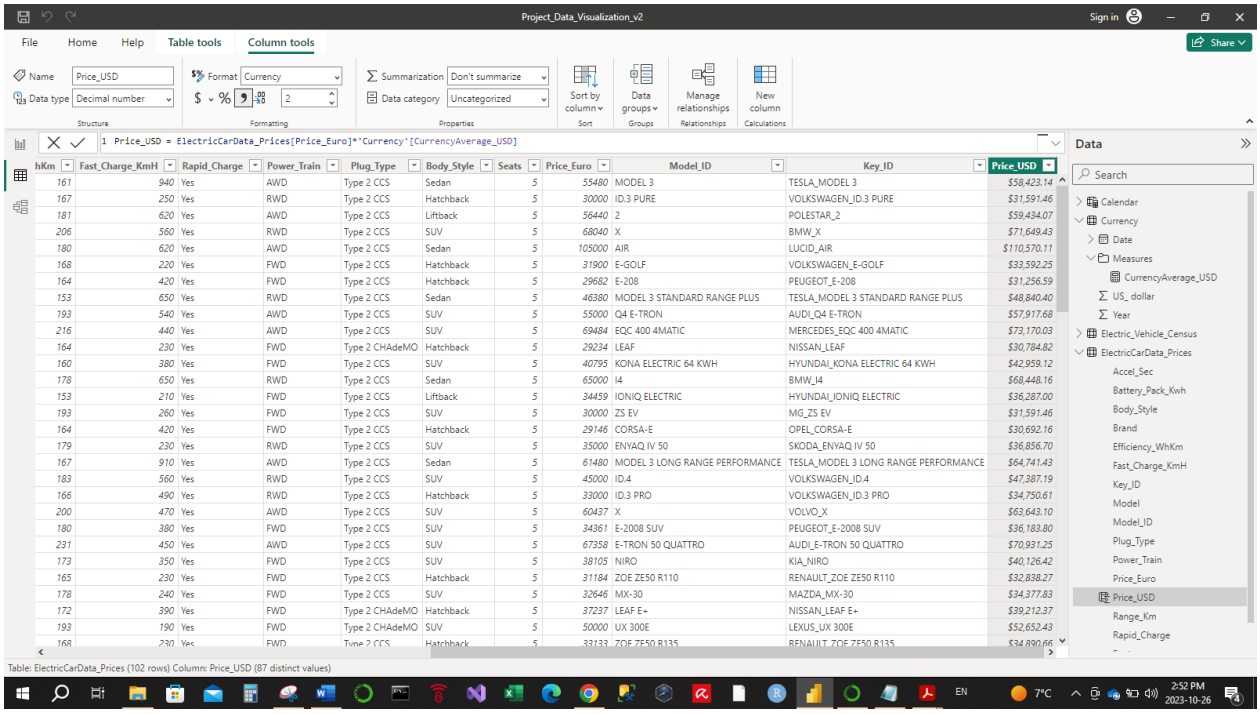
# Measures

→ **CurrencyAverage_USD** : We calculated the average currency exchange rate of USD against the Euro (EUR).




# DAX

→ In the table review, we added the equivalent US dollar price next to the 'Price_Euro' column → 'Price_USD' = 'Price_Euro' * **CurrencyAverage_USD** measure.



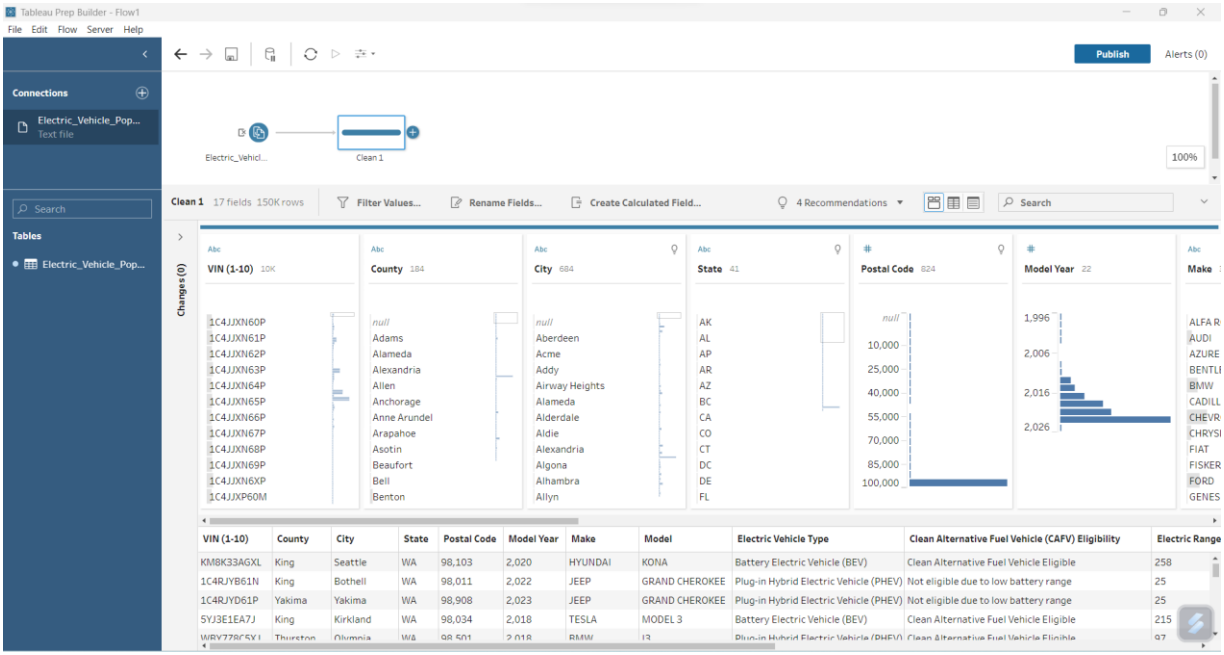
# Part B

## Data transformation in Tableau

### Cleaning

#### *Dataset No. 1: "Electric_Vehicle_Population_Data.cvs"*

**Initial screenshot**



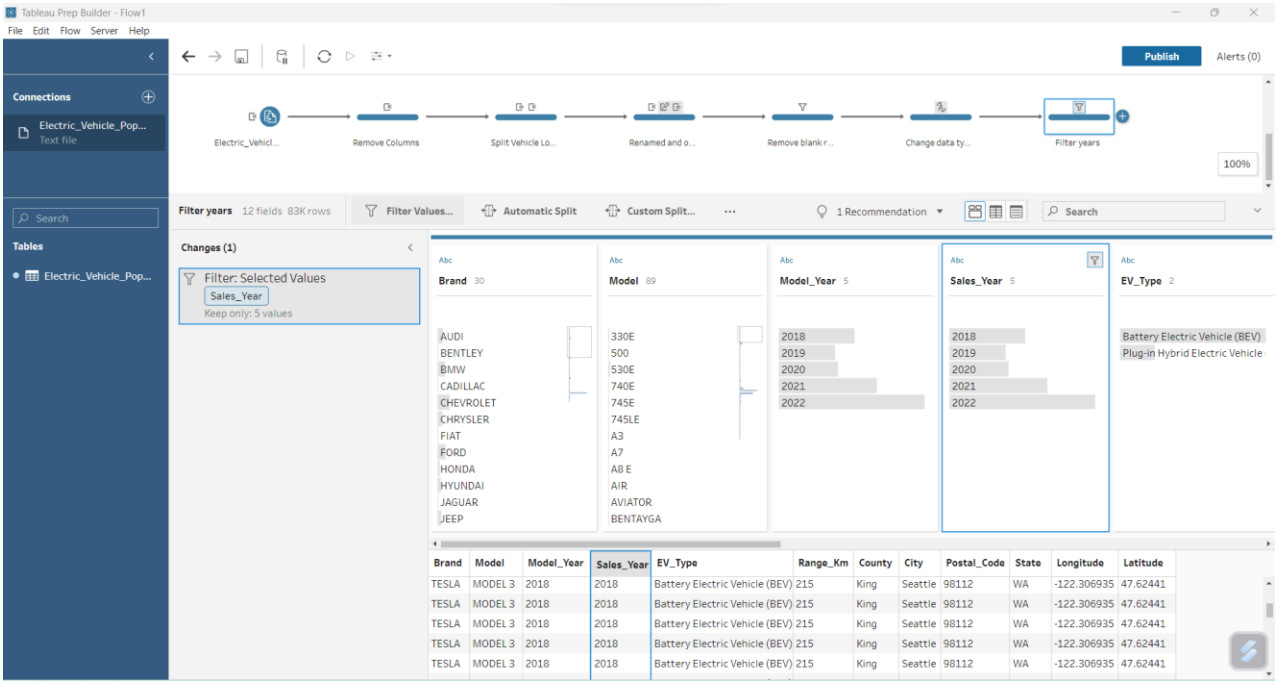

→ Renamed the file to: Electric_Vehicle_Census.
→ Removed the following columns:
'VIN (1-10)',
'Clean Alternative Fuel Vehicle (CAFV) Eligibility',
'Base MSRP',
'Legislative District',
'DOL Vehicle ID',
'2020 Census Tract'
'Electric Utility'
→ Split longitude and latitude from the 'Vehicle Location' column.
→ Renamed columns:
'Postal Code': 'Postal_Code',
'Model Year': 'Model_Year',
'Make': 'Brand',
'Electric Vehicle Type': 'EV_Type',
'Electric Range': 'Range_Km'
→ Removed blank rows.
→ Based on the column "Model_Year", created a new "*column for example*" called Sales_Year.
→ Reorder Columns:
Brand,
Model,

Model_Year,
Sales_Year,
EV_Type,
Range_Km,
County,
City,
Postal_Code,
State,
Longitude,
Latitude.

→ Changed data types.

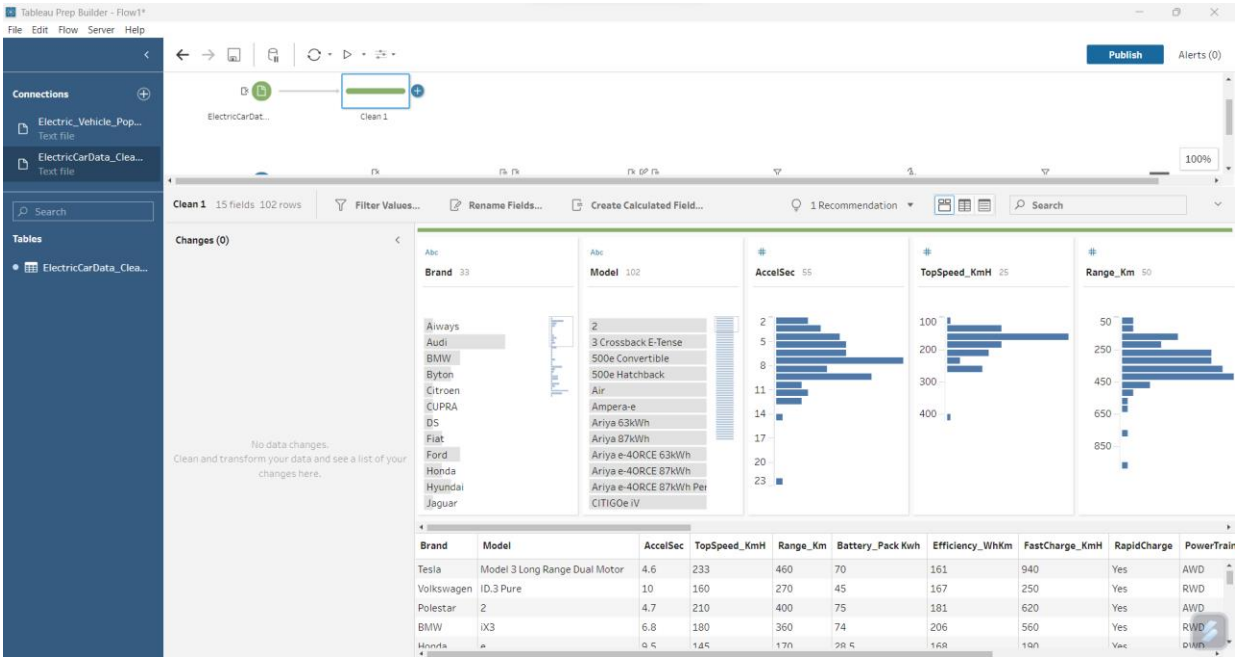
→ Filtered Sales_Year only from 2018 to 2022.

**Final screenshot**



## *Dataset No. 2: "ElectricCarData_Clean_Me.cvs"*

**Initial screenshot**

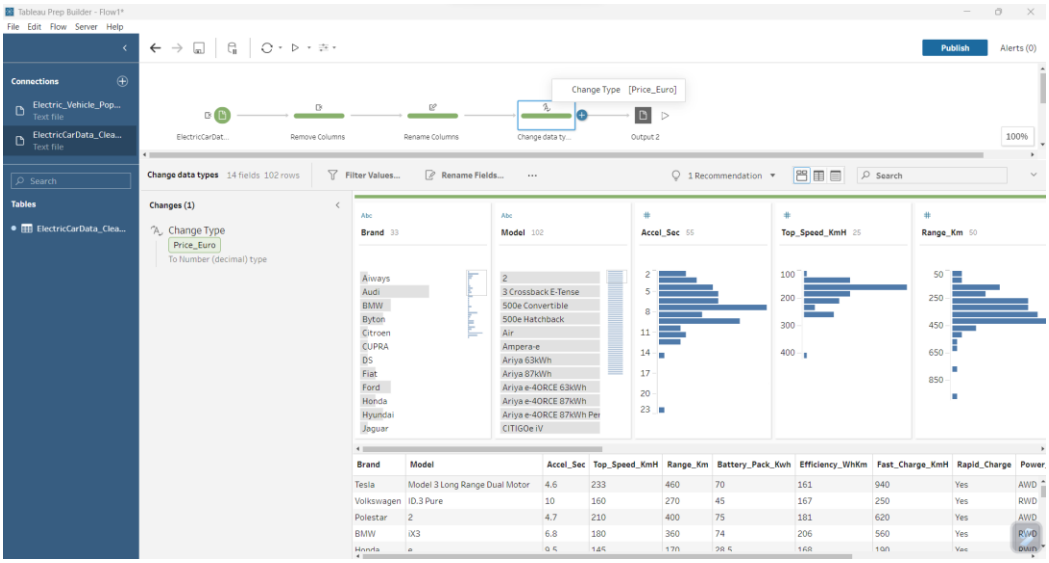



→ Renamed the file to: ElectricCarData_Prices.
→ Removed the column "Segment".
→ Renamed columns:

'AccelSec': 'Accel_Sec',
'TopSpeed_KmH': 'Top_Speed_KmH',
'Battery_Pack Kwh': 'Battery_Pack_Kwh',
'FastCharge_KmH': 'Fast_Charge_KmH',
'RapidCharge': 'Rapid_Charge',
'PowerTrain': 'Power_Train',
'PlugType': 'Plug_Type',
'BodyStyle': 'Body_Style',
'PriceEuro': 'Price_Euro'

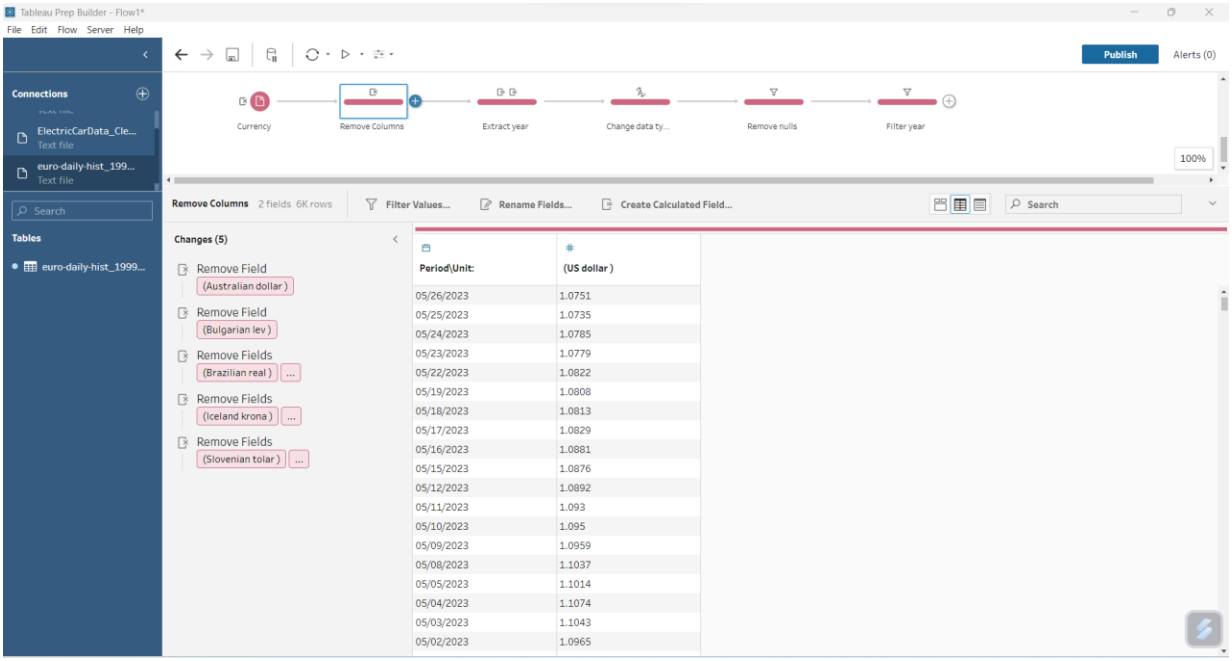
→ Changed data types.

**Final screenshot**



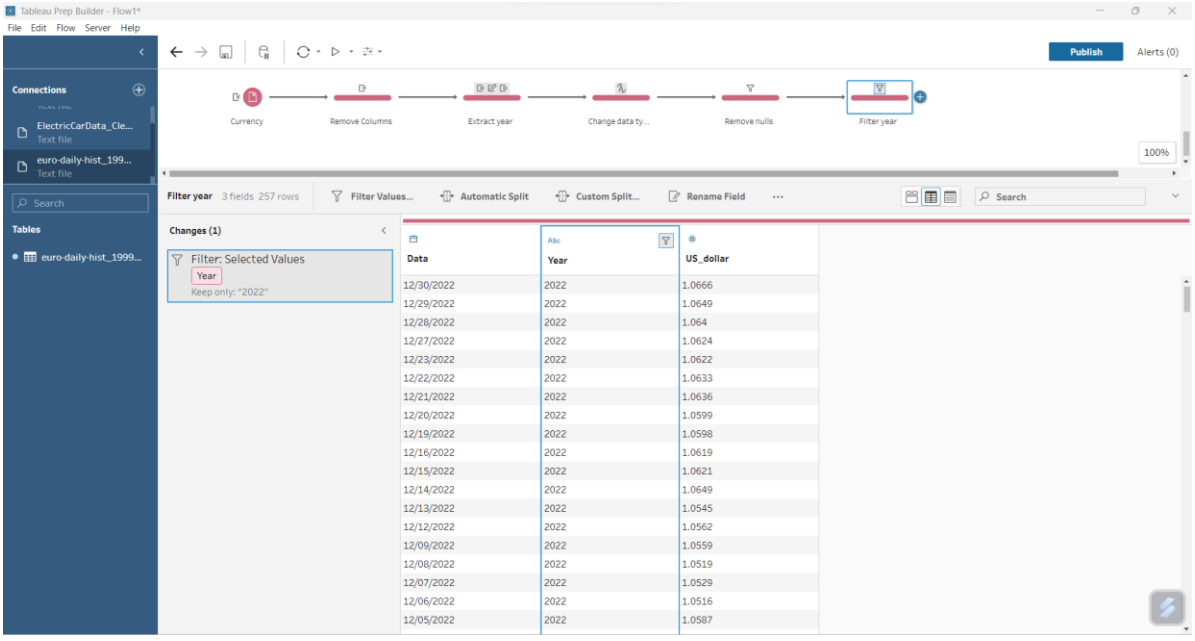
## *Dataset No. 3: "euro-daily-hist_1999_2022.cvs"*

**Initial screenshot**



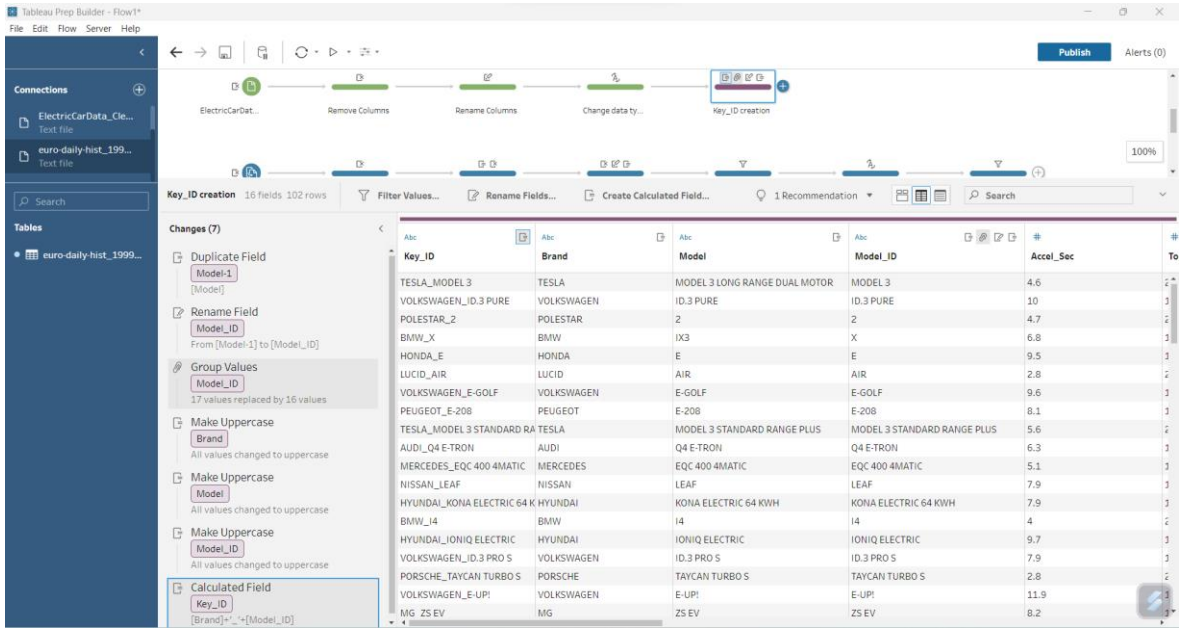

- → Renamed the file to: Currency.
- → Remove all column except from "Period\Unit:", and "[US dollar]".
- → Renamed columns:
  ' Period\Unit:': 'Date',
  ' US dollar ': 'US_dollar',
- → Extracted the year from the "Date" column. Created a new "*custom column*" → Used Power Query M formula: Date.Year([Date]).
- → Changed data types.
- → Removed errors.
- → Filtered Year only from 2022.

**Final screenshot**

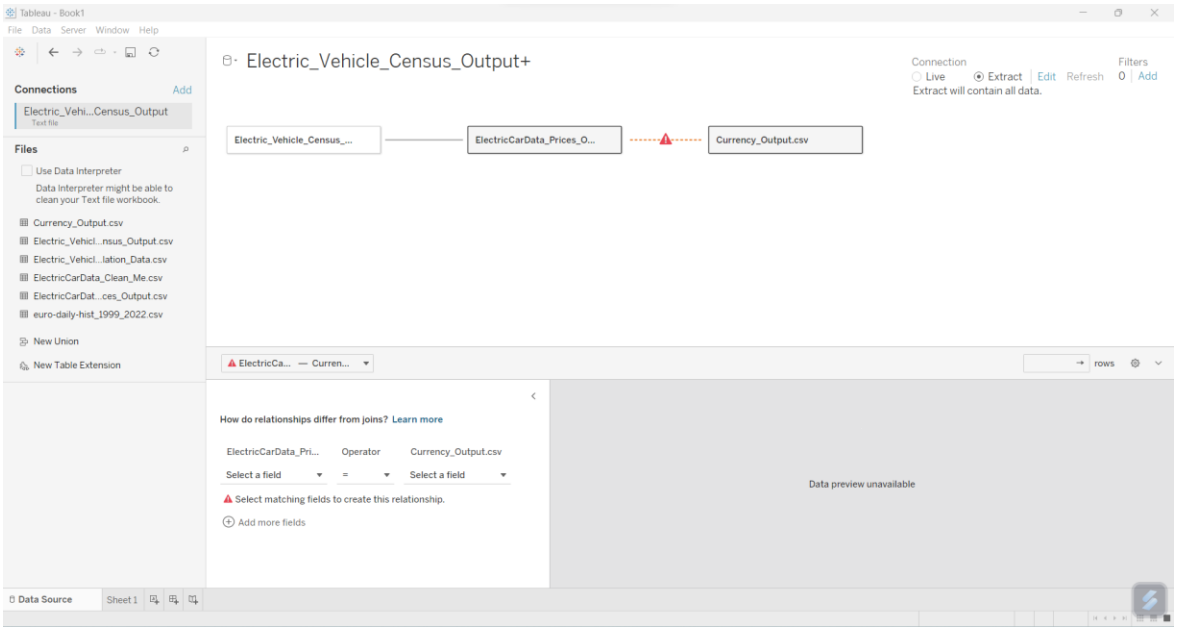


→ In the “ElectricCarData_Prices” file, we modified the ‘Model’ column to match the ‘Model’ Column of the “Electric_Vehicle_Census query”. This modification is held in the ‘Model_ID’ Column.

→ Now that we standardized the ‘Model’ car in both files, we created a primary KEY in both called ‘Key_ID’ which concatenates ‘Brand’ and ‘Model_ID’ columns.

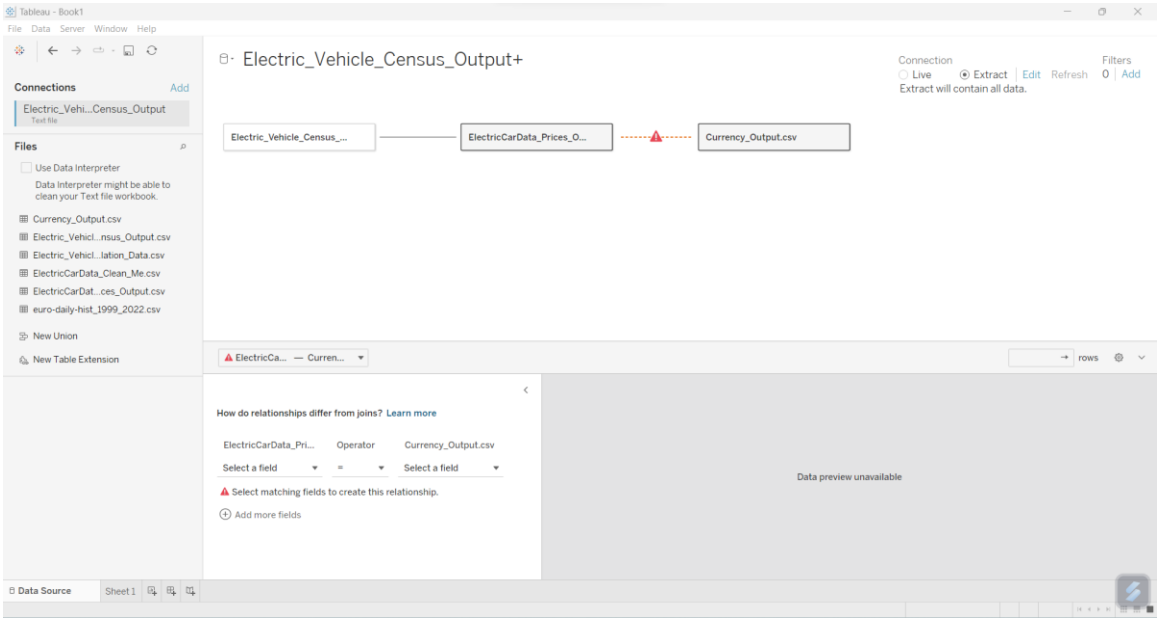



# Connecting the data



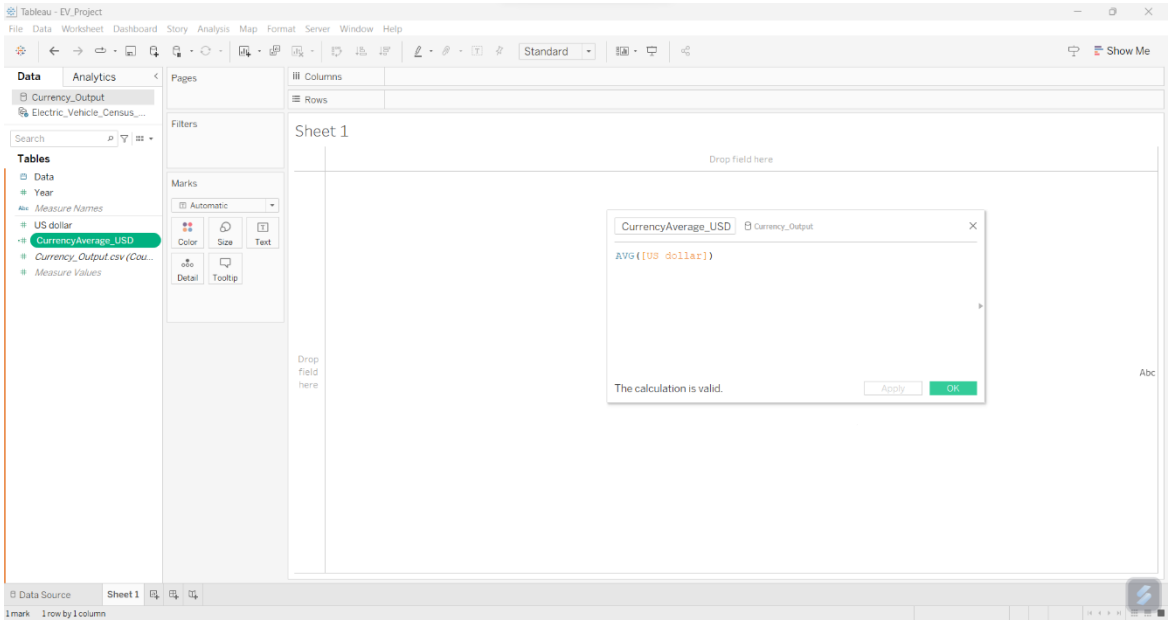
# Relation Model

Once we've cleaned and transformed our dataset using Tableau Prep, we proceed to connect the data to Tableau to initiate the visualization process. The 'ElectricCarData_Prices_Output' file is linked to the 'Electric_Vehicle_Census_Output' through the shared Key_ID present in both tables.

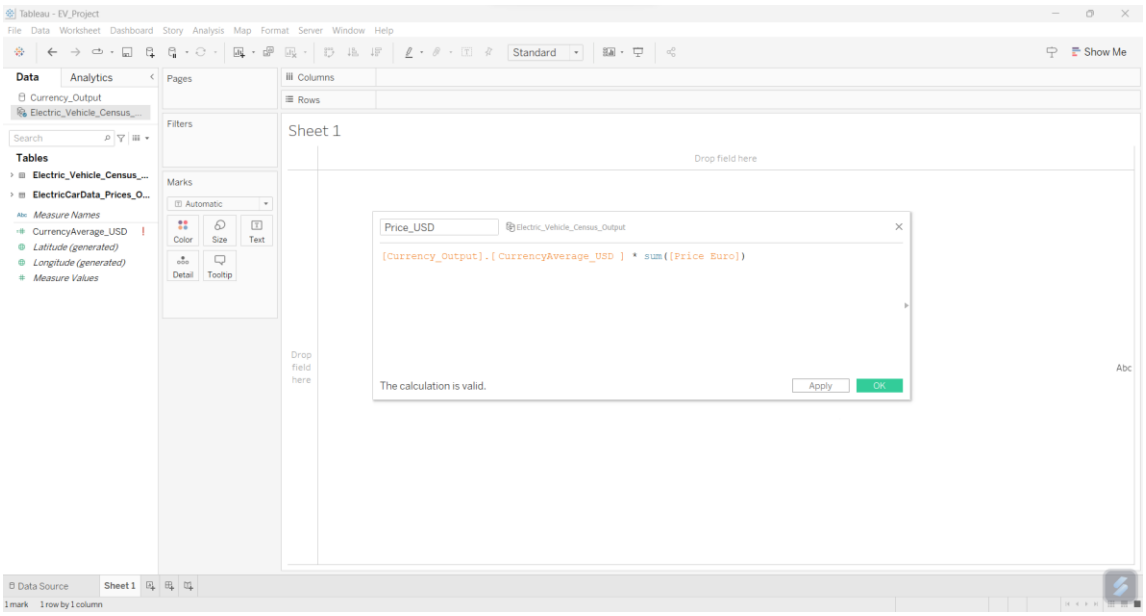



# Measures

→ **CurrencyAverage_USD** : We calculated the average currency exchange rate of USD against the Euro (EUR).



→ **Price_USD** : We converted Euro (EUR) into USD.

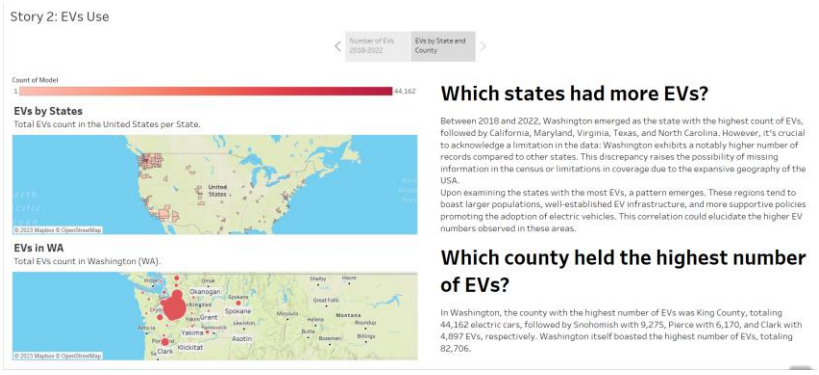



# Stories

We decided to create 5 stories, 2 of them are for introductions and conclusions, and the other three are divided into 3 categories: EVs use, User preferences, and EVs performance. We classified our analysis questions within these categories and answered them accordingly.

Story 1: Introduction


Story 2: EVs Use



Story 3: User Preferences

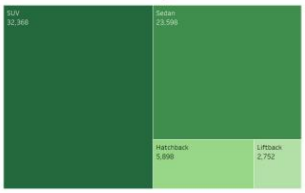
EVs by Brand | EVs by Stlye

## Which style of EVs do people tend to gravitate towards?

It appears that SUVs hold the top spot as the preferred style among EVs, totaling 32,368 cars in the survey.

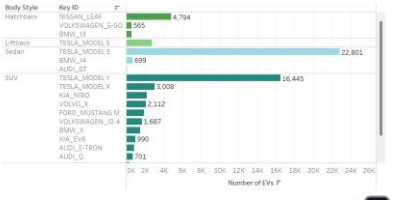
### EVs by Style

Total EVs count by styles exclusively for the following brands: Audi, BMW, Ford, Kia, Nissan, Tesla, Volkswagen, and Volvo.




### EVs Style Breakdown

Total EVs count by style, brand and model, exclusively for the following brands: Audi, BMW, Ford, Kia, Nissan, Tesla, Volkswagen, and Volvo.




Story 4: EVs Performance

EVs Battery Pack and Efficiency | EVs Acceleration and Top Speed | EVs Price

### Price Trend


### Price Correlation

| EVs Features | Accel Sec | Battery Pack.. | Efficiency W.. | Fast Charge .. | Price Euro | Range Km | Seats | Top Speed K.. |
|---|---|---|---|---|---|---|---|---|
| Accel_Sec | 1.000 | -0.678 | -0.383 | -0.783 | -0.627 | -0.678 | -0.176 | -0.786 |
| Battery_Pack_Kwh | -0.678 | 1.000 | 0.641 | 0.694 | 0.657 | 0.910 | 0.330 | 0.722 |
| Efficiency_WhKm | -0.383 | 0.641 | 1.000 | 0.318 | 0.395 | 0.314 | 0.302 | 0.355 |
| Fast_Charge_KmH | -0.783 | 0.694 | 0.318 | 1.000 | 0.658 | 0.754 | 0.264 | 0.778 |
| Price_Euro | -0.627 | 0.657 | 0.395 | 0.658 | 1.000 | 0.677 | 0.022 | 0.829 |
| Range_Km | -0.678 | 0.910 | 0.314 | 0.754 | 0.677 | 1.000 | 0.300 | 0.748 |
| Seats | -0.176 | 0.330 | 0.302 | 0.264 | 0.022 | 0.300 | 1.000 | 0.127 |
| Top_Speed_KmH | -0.786 | 0.722 | 0.355 | 0.778 | 0.829 | 0.748 | 0.127 | 1.000 |

## Are specific features of EVs linked to their pricing?

The price of a vehicle shows a correlation with several attributes, including acceleration, speed, kilometer range, battery pack capacity, efficiency, and fast charging. Among these attributes, speed exhibits the strongest correlation with price. Interestingly, the number of seats does not appear to have a significant correlation with the price. Now, we believe the cost of a vehicle is not solely determined by a specific feature. Instead, it's influenced by a mix of factors such as branding, target audience, and the overall package a car offers.

Story 5: Conclusion

Conclusion | Next Steps

## Conclusion

Over the past five years, the use of electric vehicles (EVs) has steadily increased in the USA, according to the data analysis. In the market, Tesla was the clear leader, with Nissan, Chevrolet, and Kia trailing closely behind. SUVs became the favored option for electric vehicle purchasers, and producers engaged in intense competition to provide larger battery capacities and enhanced efficiency.

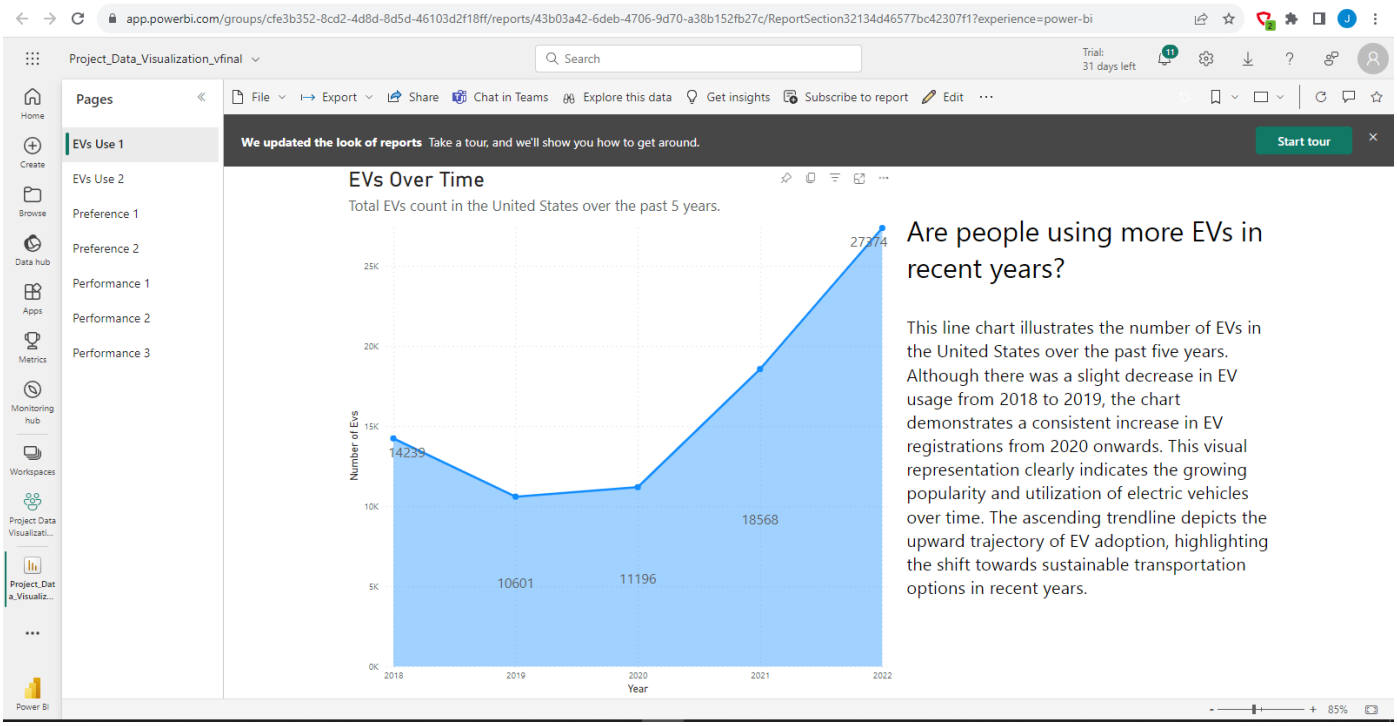
Even though characteristics like speed showed a direct correlation with price, we think that an EV's total cost is influenced by several different factors, such as branding and target demographics. We do see a constraint with the dataset, even if we were able to respond to our analysis query. For more accurate and thorough research, larger data coverage including many US states is necessary to have a comprehensive knowledge of countrywide EV trends.

# Workspace and Dashboard in PowerBI

After developing all the reports in PowerBI Desktop, we decided, to publish them in a Workspace, and then to create a Dashboard in Power BI App. Following the link to access the App (access have been granted in advance only to the professor and group members):

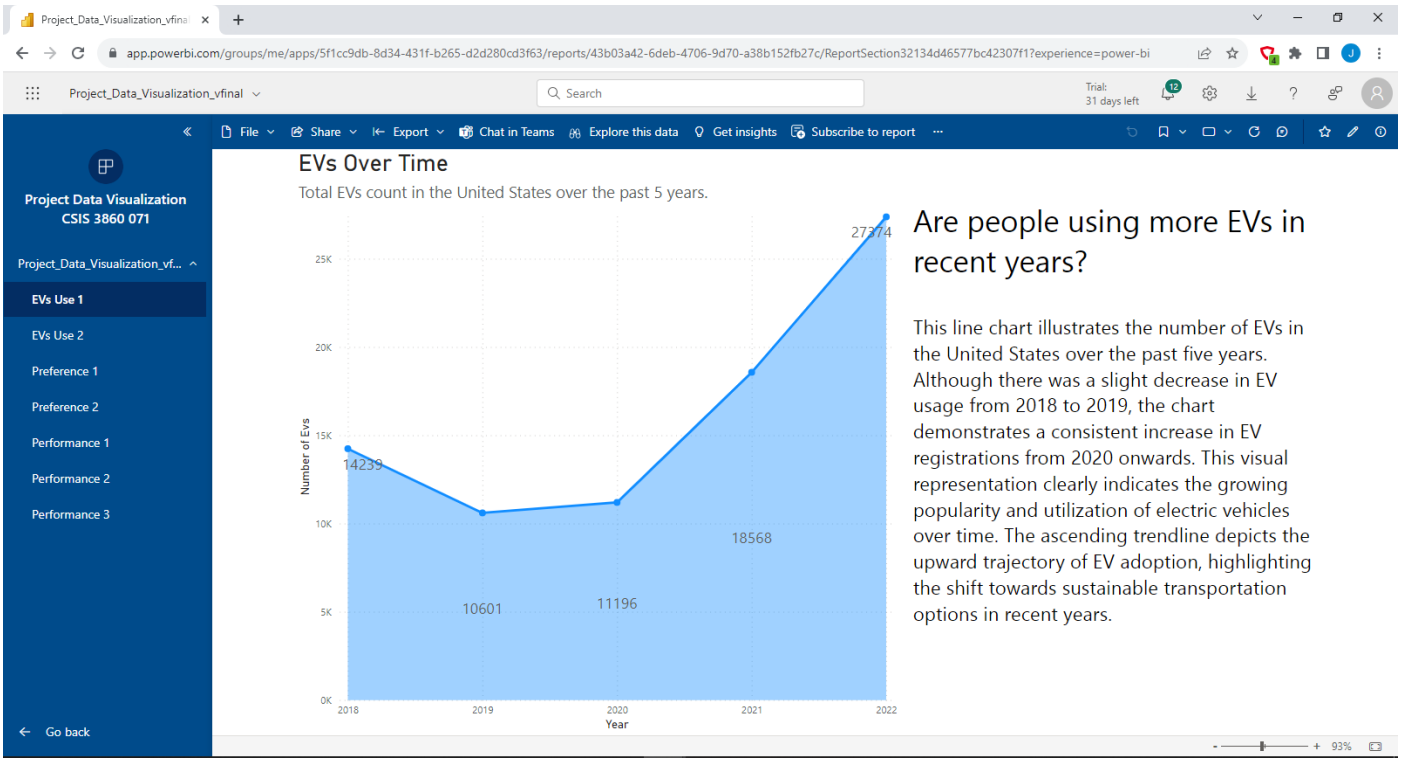
Link of the Workspace “Project Data Visualization CSIS 3860 071”:

https://app.powerbi.com/links/AsR2gfTF9s?ctid=3af48838-cd53-4507-9e7f-fc6dac355e33&pbi_source=linkShare



Link of App “Project Data Visualization CSIS 3860 071”:

https://app.powerbi.com/Redirect?action=OpenApp&appId=5f1cc9db-8d34-431f-b265-d2d280cd3f63&ctid=3af48838-cd53-4507-9e7f-fc6dac355e33

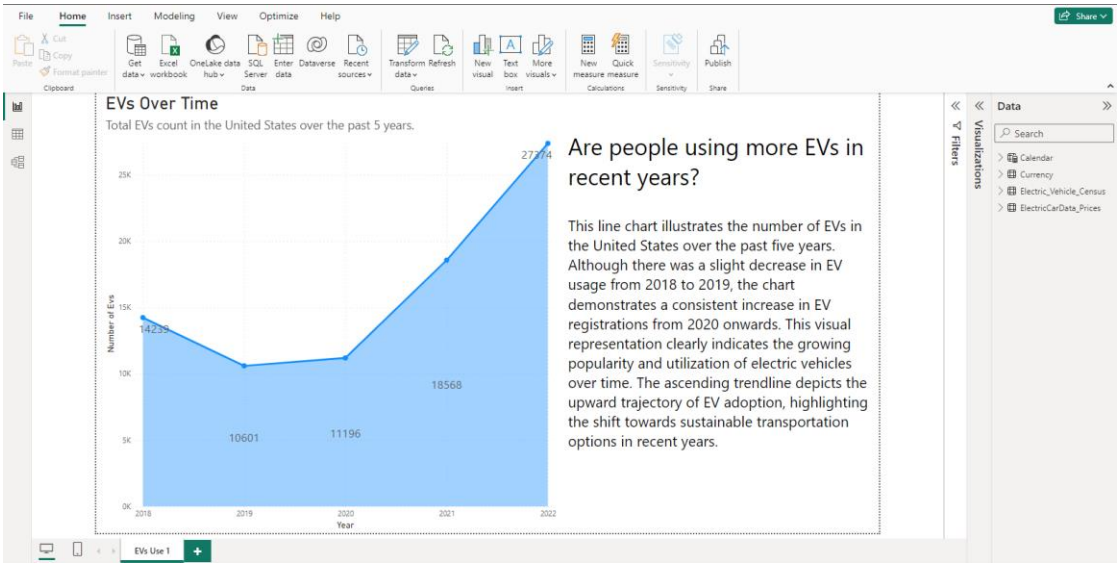


# Answers to analysis questions

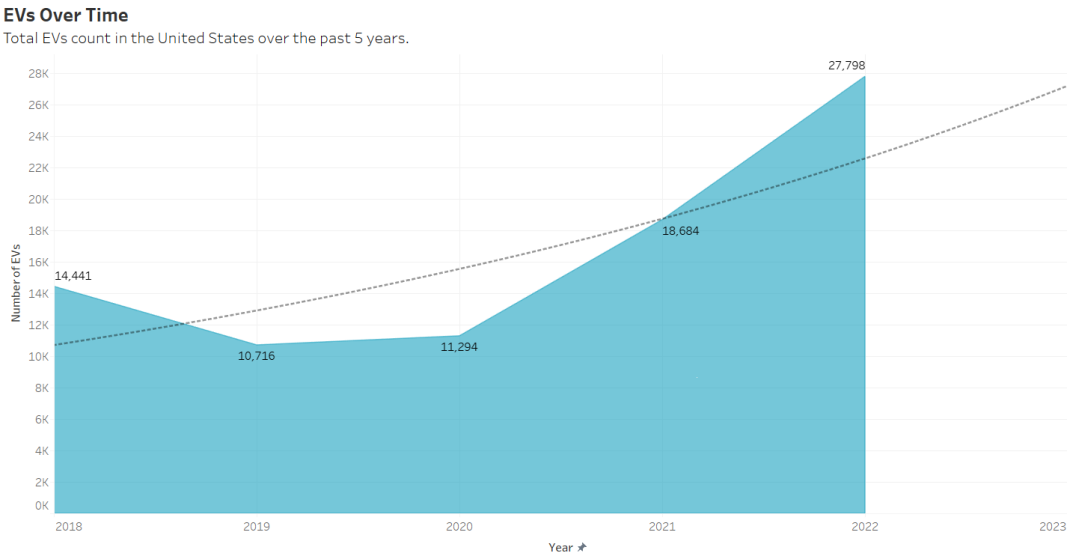
1. **Are people using more EVs in recent years?**

This line chart illustrates the number of EVs in the United States over the past five years. Although there was a slight decrease in EV usage from 2018 to 2019, the chart demonstrates a consistent increase in EV registrations from 2020 onwards. This visual representation indicates the growing popularity and utilization of electric vehicles over time. The ascending trendline depicts the upward trajectory of EV adoption, highlighting the shift towards sustainable transportation options in recent years.

Screenshot Power BI:




Screenshot Tableau:



## 2. Which state had more EVs?

Between 2018 and 2022, Washington emerged as the state with the highest count of EVs, followed by California, Maryland, Virginia, Texas, and North Carolina. However, it's crucial to acknowledge a limitation in the data: Washington exhibits a notably higher number of records compared to other states. This discrepancy raises the possibility of missing information in the census or limitations in coverage due to the expansive geography of the USA.

Upon examining the states with the most EVs, a pattern emerges. These regions tend to boast larger populations, well-established EV infrastructure, and more supportive policies promoting the adoption of electric vehicles. This correlation could elucidate the higher EV numbers observed in these areas.

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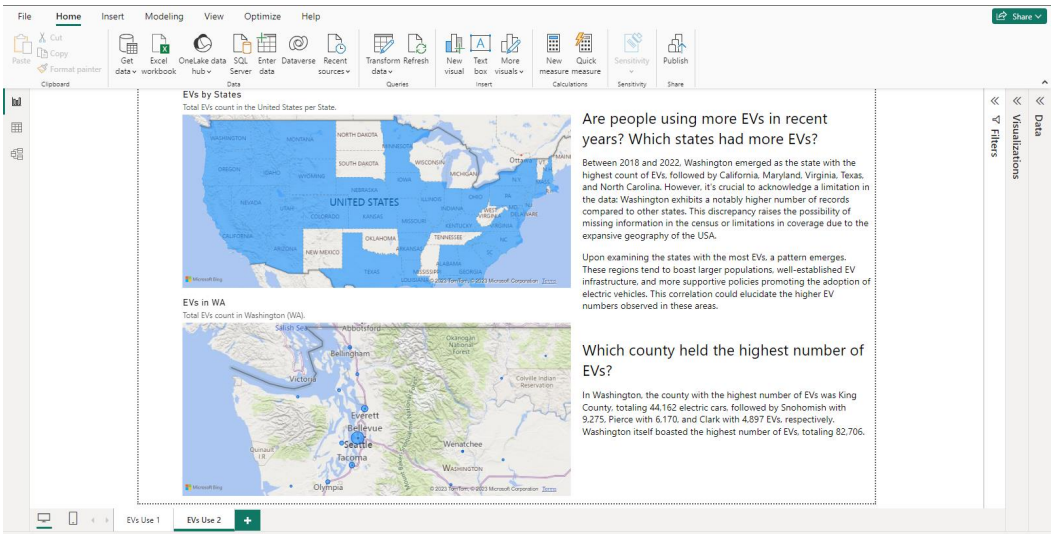
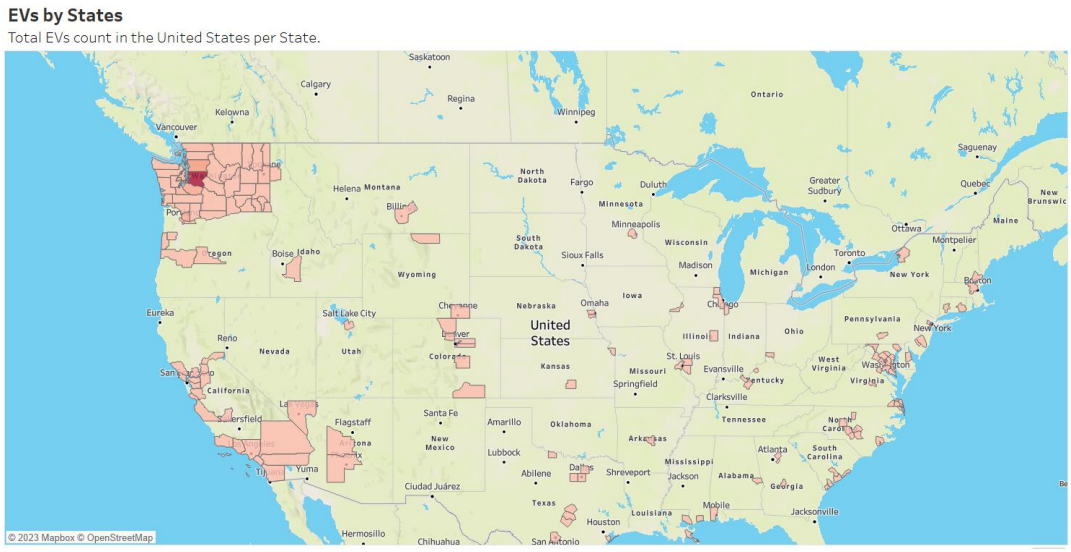



Screenshot Tableau:



### 3. Which county held the highest number of EVs?

In Washington, the county with the highest number of EVs was King County, totaling 44,162 electric cars, followed by Snohomish with 9,275, Pierce with 6,170, and Clark with 4,897 EVs, respectively. Washington itself boasted the highest number of EVs, totaling 82,706.

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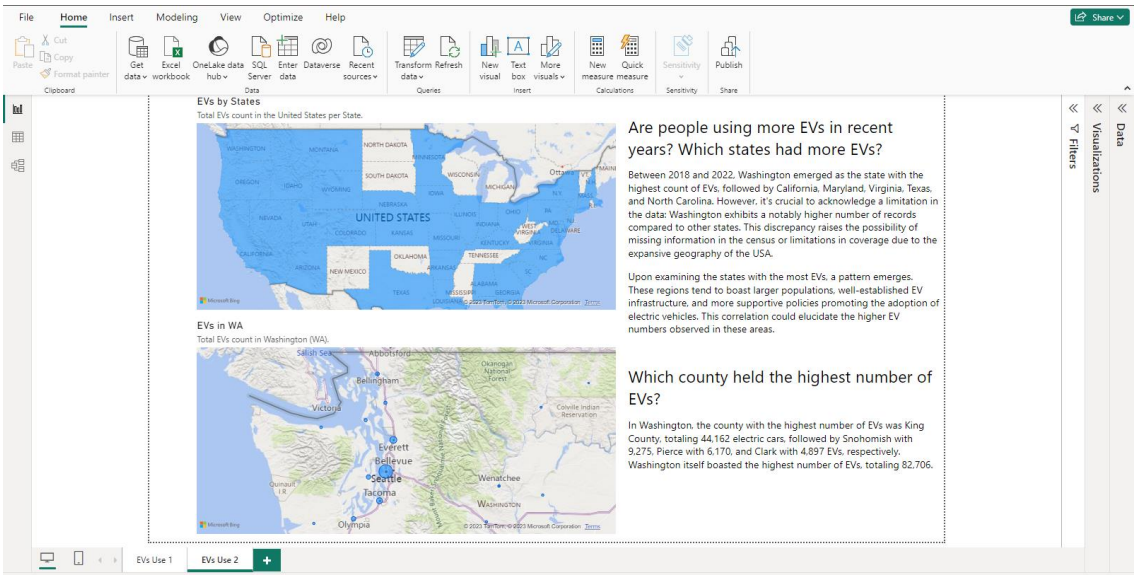


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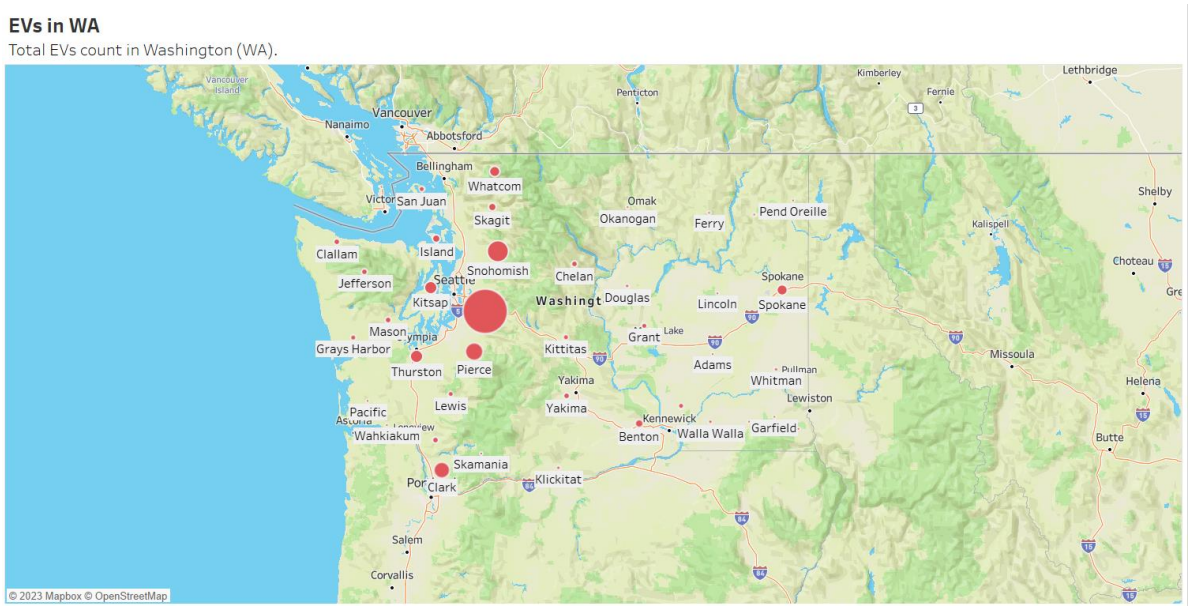

4. **Which manufacturer had the majority of EVs?**

Between 2018 and 2022, Tesla emerged as the manufacturer with the highest number of electric vehicles (EVs) recorded in the census, accounting for the majority at 54.27% of the total surveyed vehicles. Following Tesla were manufacturers such as Nissan, Chevrolet, and Kia.

The results of our analysis demonstrate Tesla's leadership position in the US electric vehicle market. With models like the Model S, Model 3, Model X, and Model Y, among others, their extensive range of vehicles has become extremely popular and has played a major role in the mass adoption of EVs.

While other manufacturers like Volkswagen, Nissan, and Chevrolet actively develop noteworthy EV options, striving to expand their production and market presence, Tesla has consistently maintained its leadership position in the market.

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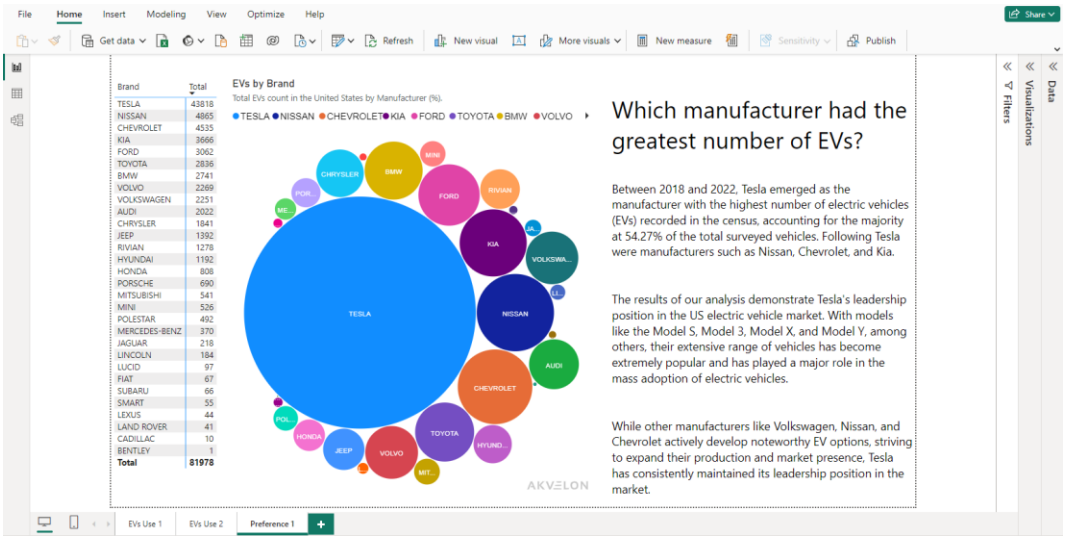


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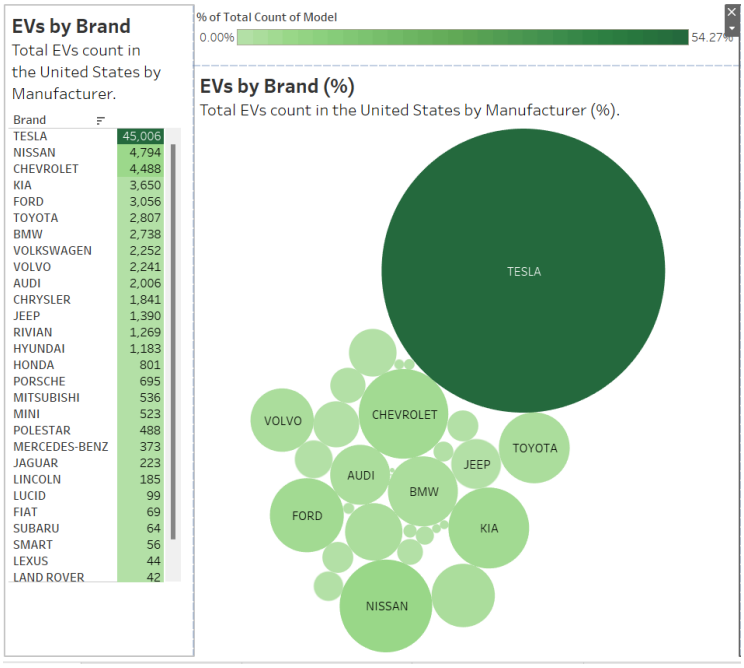

5. **Which style of EVs do people tend to gravitate towards?**

It appears that SUVs hold the top spot as the preferred style among EVs, totaling 32,368 cars in the survey.

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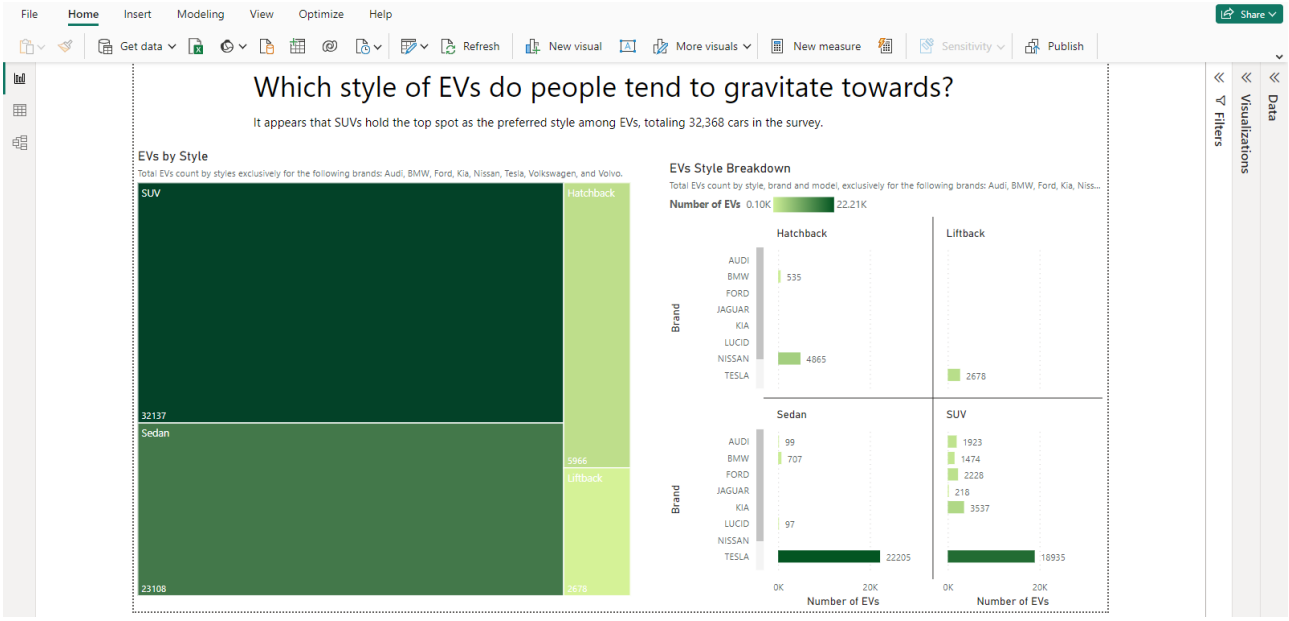


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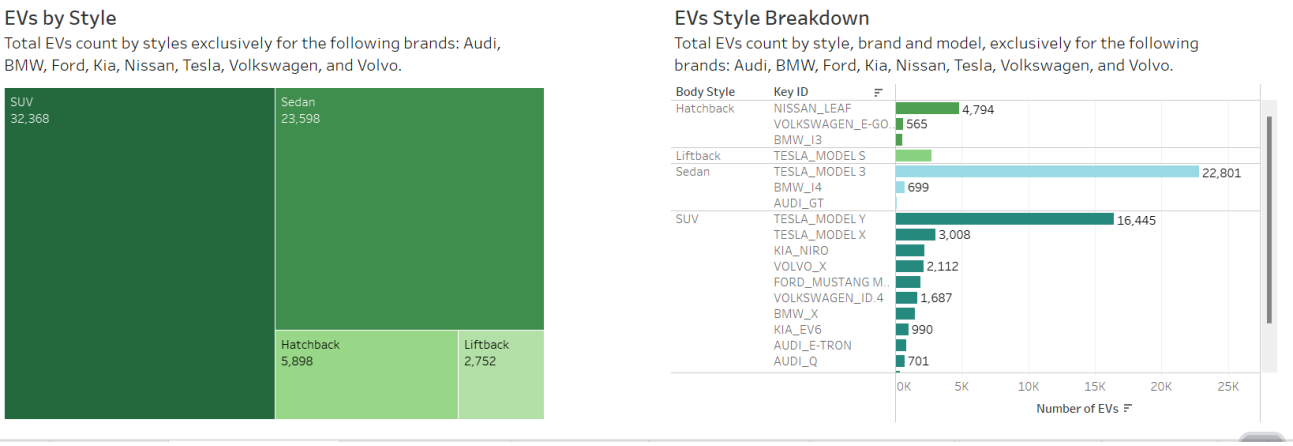

### 6. Which manufacturer had the highest battery pack capacity?

Regarding battery Pack Capacity, the contenders at the forefront are Lucid, Tesla, and Ford.

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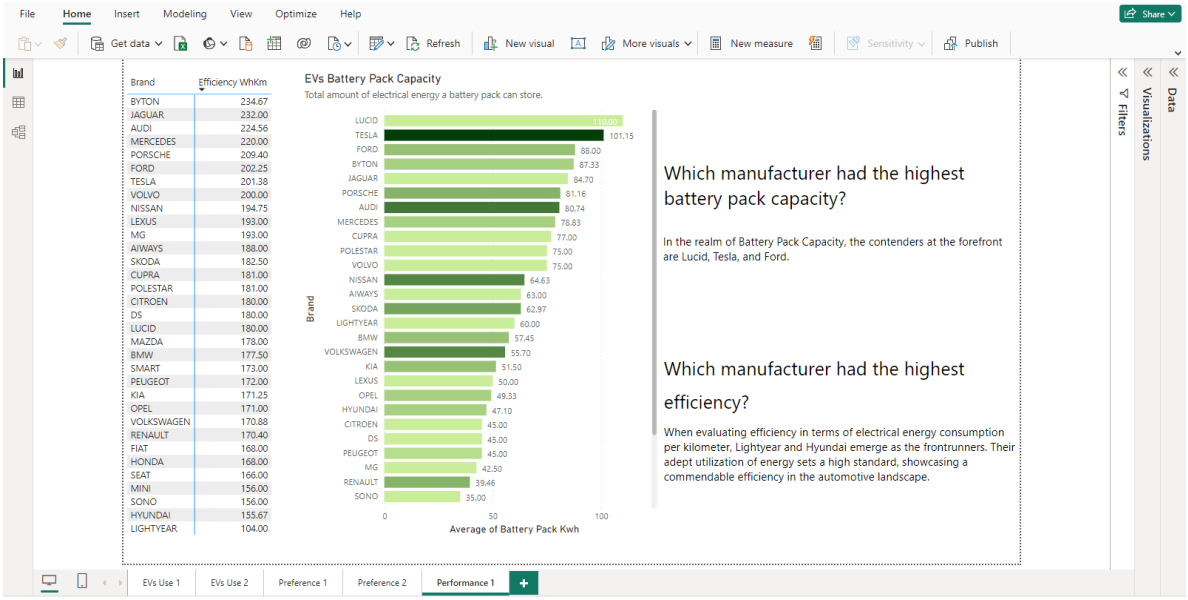


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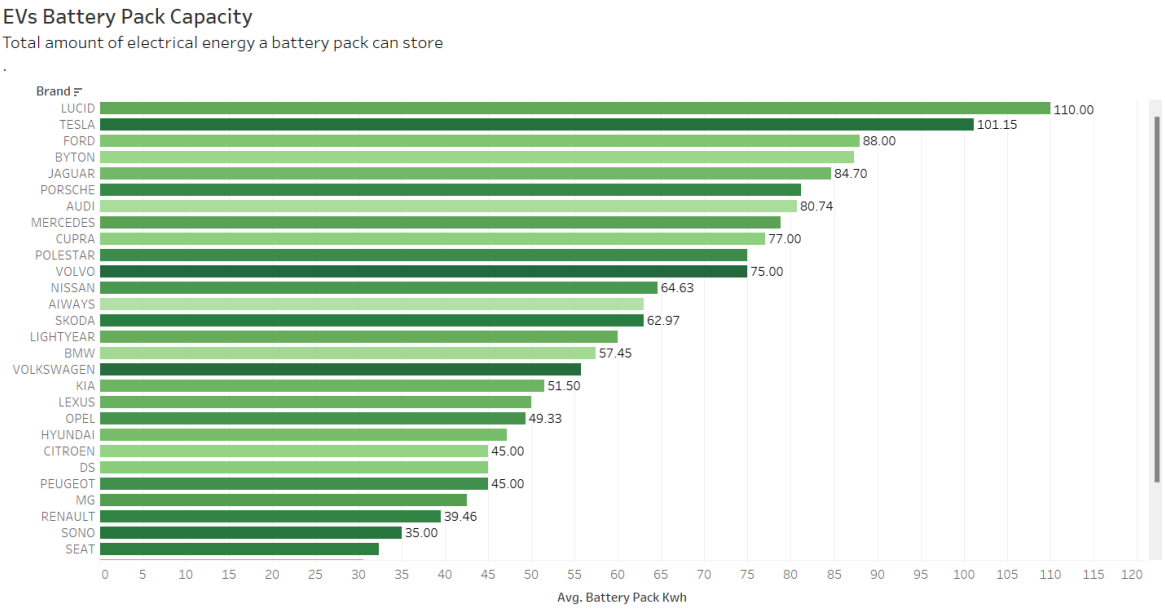

## 7. Which manufacturer had the highest efficiency?

When evaluating efficiency in terms of electrical energy consumption per kilometer, Lightyear and Hyundai emerge as the frontrunners. Their adept energy utilization sets a high standard, showcasing commendable efficiency in the automotive landscape.

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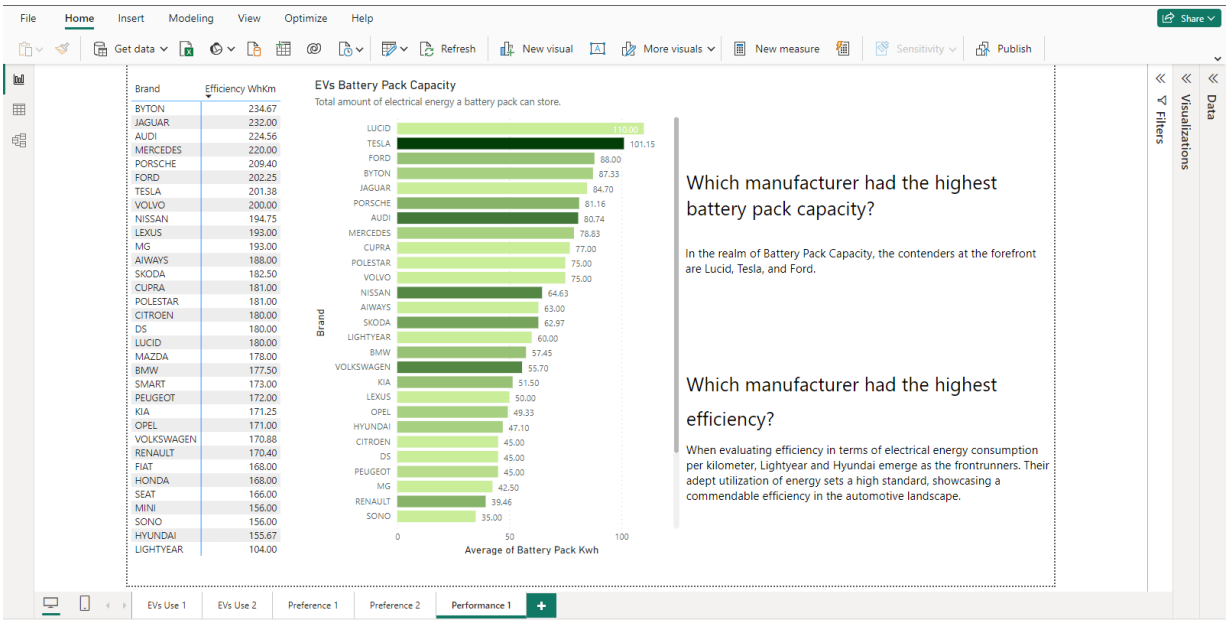


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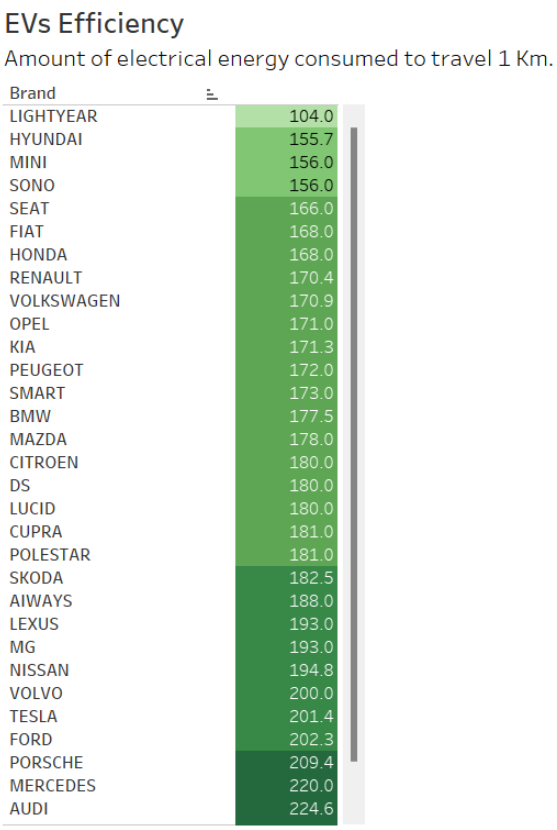

## 8. Which manufacturer had the lowest acceleration?

Among well-known automakers, Tesla, Porsche, and Lucid all provide distinct acceleration experiences. In contrast to the performance-driven mindset of Porsche and Tesla, Lucid may provide vehicles with slightly more progressive acceleration, even though its focus is luxury and range. Faster acceleration is a common outcome of Tesla's innovations and Porsche's emphasis on engineering perfection throughout their lineup. However, because each brand has a broad inventory that meets the needs and tastes of different drivers, certain models within each brand can differ dramatically in terms of acceleration.

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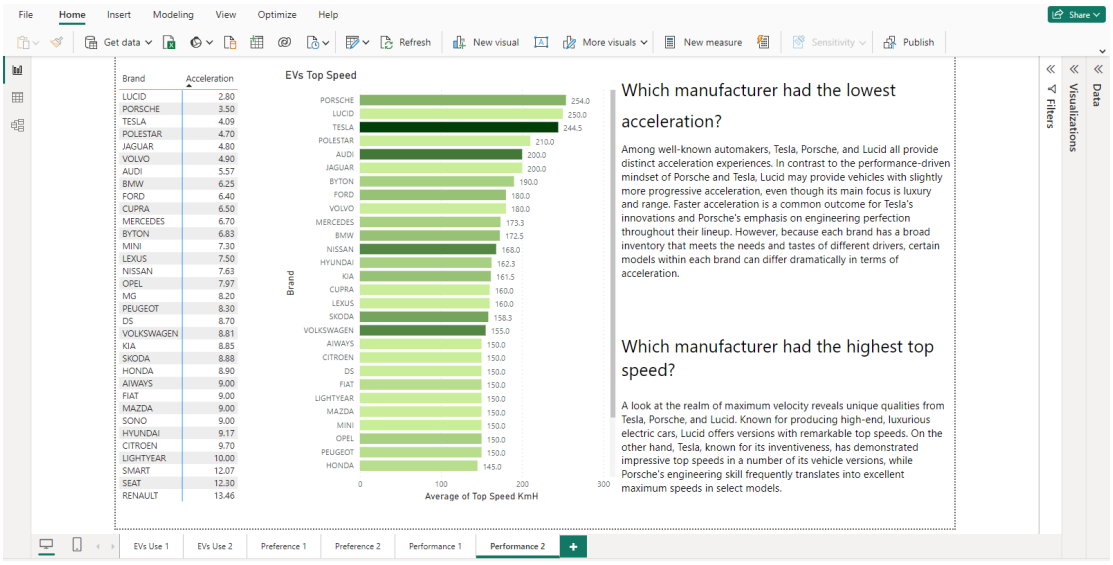


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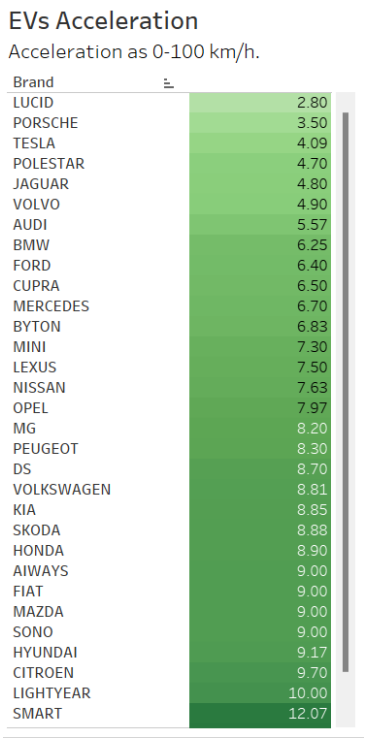

### 9. Which manufacturer had the highest top speed?

A look at the realm of maximum velocity reveals unique qualities from Tesla, Porsche, and Lucid. Known for producing high-end, luxurious electric cars, Lucid offers versions with remarkable top speeds. On the other hand, Tesla, known for its inventiveness, has demonstrated impressive top speeds in some of its vehicle versions, while Porsche's engineering skill frequently translates into excellent maximum speeds in select models.

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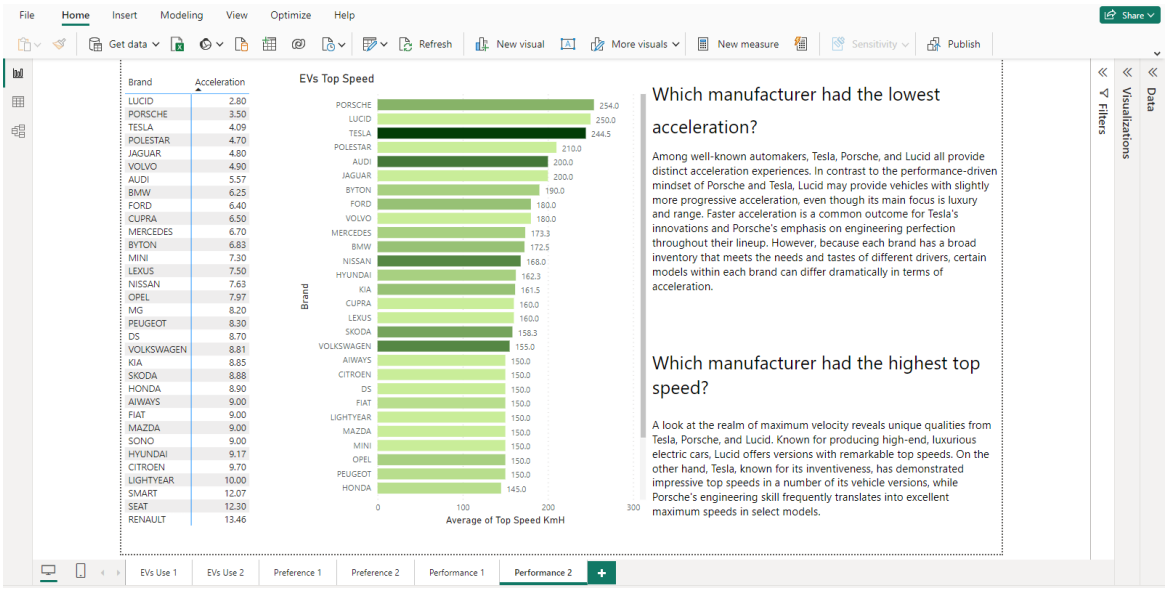


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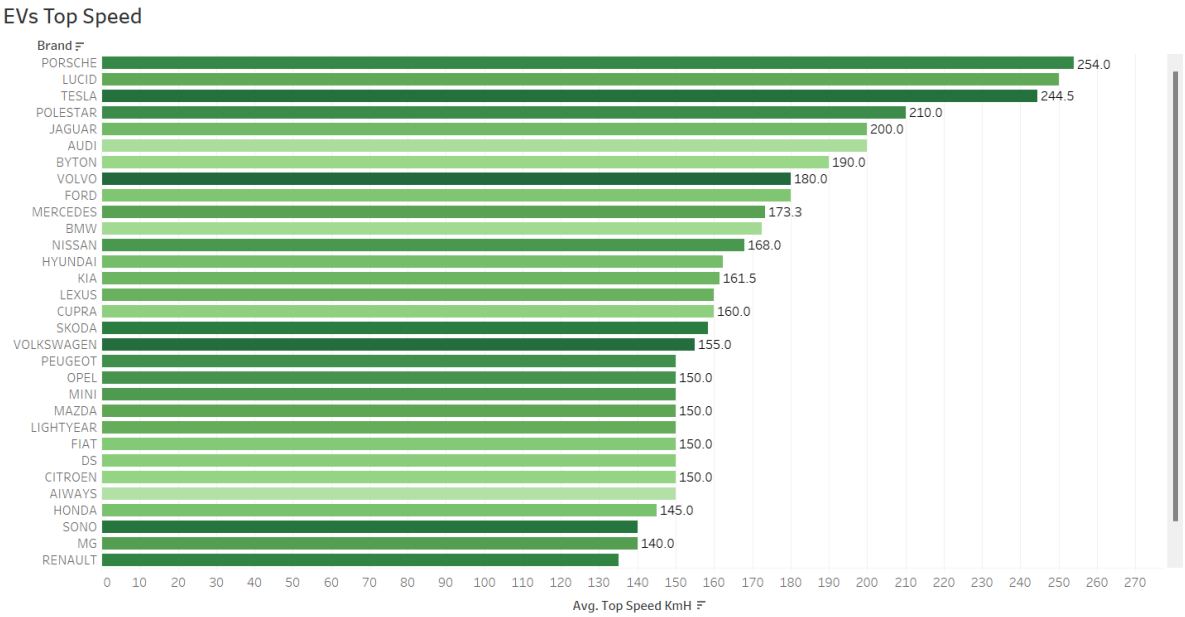

## 10. Are specific features of EVs linked to their pricing?

The price of a vehicle shows a correlation with several attributes, including acceleration, speed, kilometer range, battery pack capacity, efficiency, and fast charging. Among these attributes, speed exhibits the strongest correlation with price. Interestingly, the number of seats does not appear to have a significant correlation with the price.

Now, we believe the cost of a vehicle is not solely determined by a specific feature. Instead, it's influenced by a mix of factors such as branding, target audience, and the overall package a car offers.

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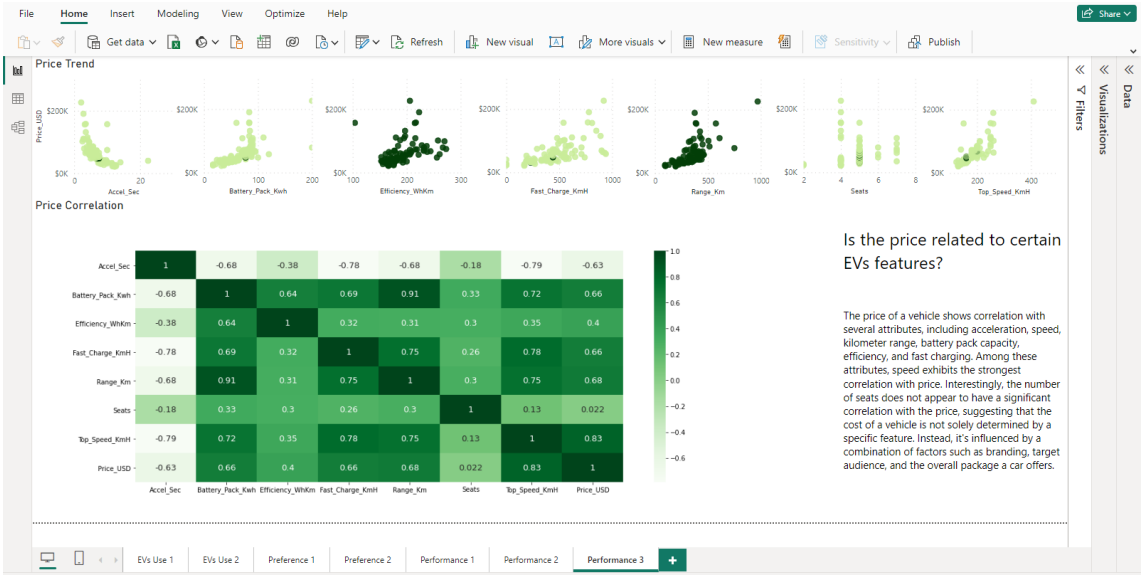


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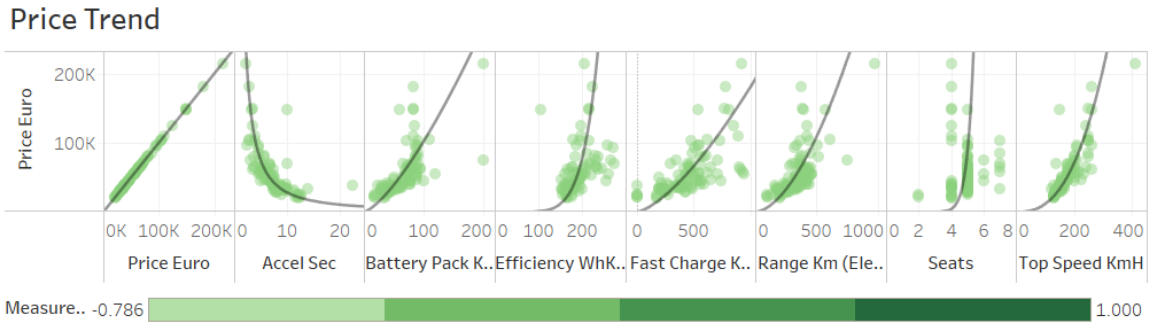


Price Correlation

| EVs Features | Accel Sec | Battery Pack.. | Efficiency W.. | Fast Charge .. | Price Euro | Range Km | Seats | Top Speed K.. |
|---|---|---|---|---|---|---|---|---|
| Accel_Sec | 1.000 | -0.678 | -0.383 | -0.783 | -0.627 | -0.678 | -0.176 | -0.786 |
| Battery_Pack_Kwh | -0.678 | 1.000 | 0.641 | 0.694 | 0.657 | 0.910 | 0.330 | 0.722 |
| Efficiency_WhKm | -0.383 | 0.641 | 1.000 | 0.318 | 0.395 | 0.314 | 0.302 | 0.355 |
| Fast_Charge_KmH | -0.783 | 0.694 | 0.318 | 1.000 | 0.658 | 0.754 | 0.264 | 0.778 |
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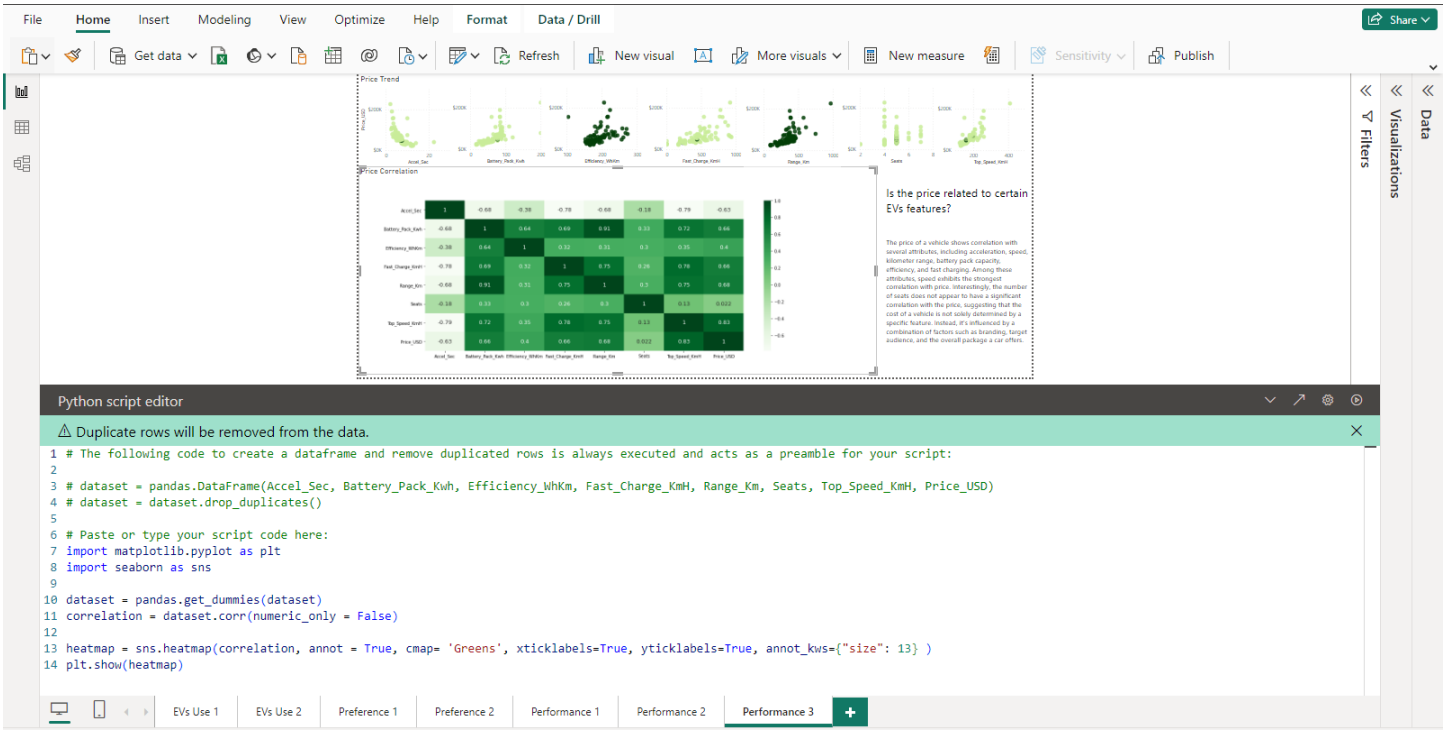
| Seats | -0.176 | 0.330 | 0.302 | 0.264 | 0.022 | 0.300 | 1.000 | 0.127 |
| Top_Speed_KmH | -0.786 | 0.722 | 0.355 | 0.778 | 0.829 | 0.748 | 0.127 | 1.000 |

In order to answer this question in Power BI, it was required to create a custom visual (heatmap of correlation) using Python Visual. Following you can see the coding details.




# Conclusion

Over the past five years, the use of electric vehicles (EVs) has steadily increased in the USA, according to the data analysis. In the market, Tesla was the clear leader, with Nissan, Chevrolet, and Kia trailing closely behind. SUVs became the favored option for electric vehicle purchasers, and producers engaged in intense competition to provide larger battery capacities and enhanced efficiency.

Even though characteristics like speed showed a direct correlation with price, we think that an EV's total cost is influenced by several different factors, such as branding and target demographics.

We do see a constraint with the dataset, even if we were able to respond to our analysis query. For more accurate and thorough research, larger data coverage including many US states is necessary to have a comprehensive knowledge of countrywide EV trends.

# Next steps

Electric vehicles (EVs) hold significant importance due to their contributions to mitigating environmental impact by reducing greenhouse gas emissions and enhancing air quality, crucial steps in combating climate change. Consequently, we advocate for the continuation and expansion of comprehensive census efforts to cover diverse geographical regions. Collecting more data periodically is necessary as it enables states to track evolving consumer trends. This information equips cities and regions with insights necessary to develop and adapt infrastructure, ensuring it adequately supports the growing demand for EVs and comprehensive analysis.

# References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- Gupta, D. *Cars Dataset with Battery Pack Capacity.* https://www.kaggle.com/datasets/divyanshugupta95/cars-dataset-with-battery-pack-capacity

- *Learning Tableau 2022 – 5th Edition by Joshua Milligan ISBN* 9781801072328 – Packt Publishing - eBook available from publisher's website and/or Book store (https://www.packtpub.com/product/learning-tableau-2022-fifth-edition/9781801072328)

- Microsoft Power BI Quick Start Guide – Preferably 3rd edition- Devin Knight, Mitchell Pearson, Bradley Schacht,, et al – ISBN 9781804613498 – Packt Publishing – eBook available from publisher's website (https://www.packtpub.com/product/microsoft-power-bi-quick-start-guide-second-edition/9781804613498)

- United States Government. (2023, November 17). *Electric Vehicle Population Data.* https://catalog.data.gov/dataset/electric-vehicle-population-data