Fuel Economy

EPA Sustainability Specialist

Iris Liu
SID: 520285488

Presented by:
Iris Liu

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The proposed standards are projected to result in an industry-wide average target for the light-duty fleet of **82** grams/mile (g/mile) of CO_2 in MY 2032, representing a 56 percent reduction in projected fleet average GHG emissions target levels from the existing MY 2026 standard.

Agenda

- Data cleaning and preparation
- Data & Variables Introduction
- Visualisation 1 + insights
- Visualisation 2 + insights
- Visualisation 3 + Insights
- Recommended strategies
- Limitations

Data Processing

1. Dropping missing data
2. Removing duplicates
3. Analyse outliners (3rd visualisation)

Variables

Data frame: vehicles_A1.csv

Basic information

- **make** - manufacturer (division)
- **model** - model name (carline)
- **trany** - transmission (e.g. automatic, manual)
- **VClass** - EPA vehicle size class
- **year** - model year
- **drive** - drive axle type
- **fuelType** - fuel type
- **cylinders** - number of engine cylinders
- **displ** - engine displacement (volume) in litres
- **engId** - EPA model type index
- **eng_dscr** - engine descriptor
- ****hlv** - hatchback luggage volume (cubic feet)
- ****hpv** - hatchback passenger volume (cubic feet)

GHG Emission

- **co2TailpipeGpm** - tailpipe CO2 in grams/mile

Positive correlation

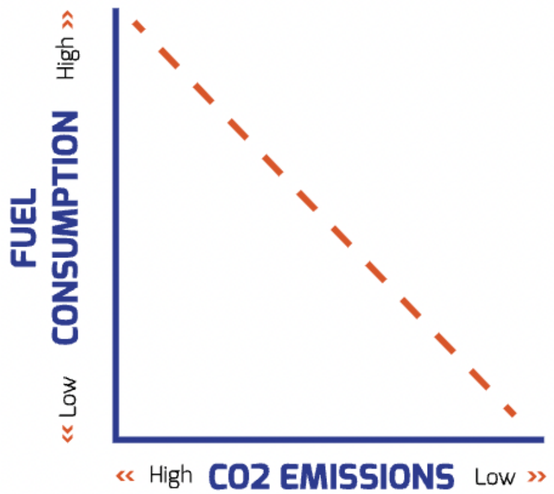
Negative correlation

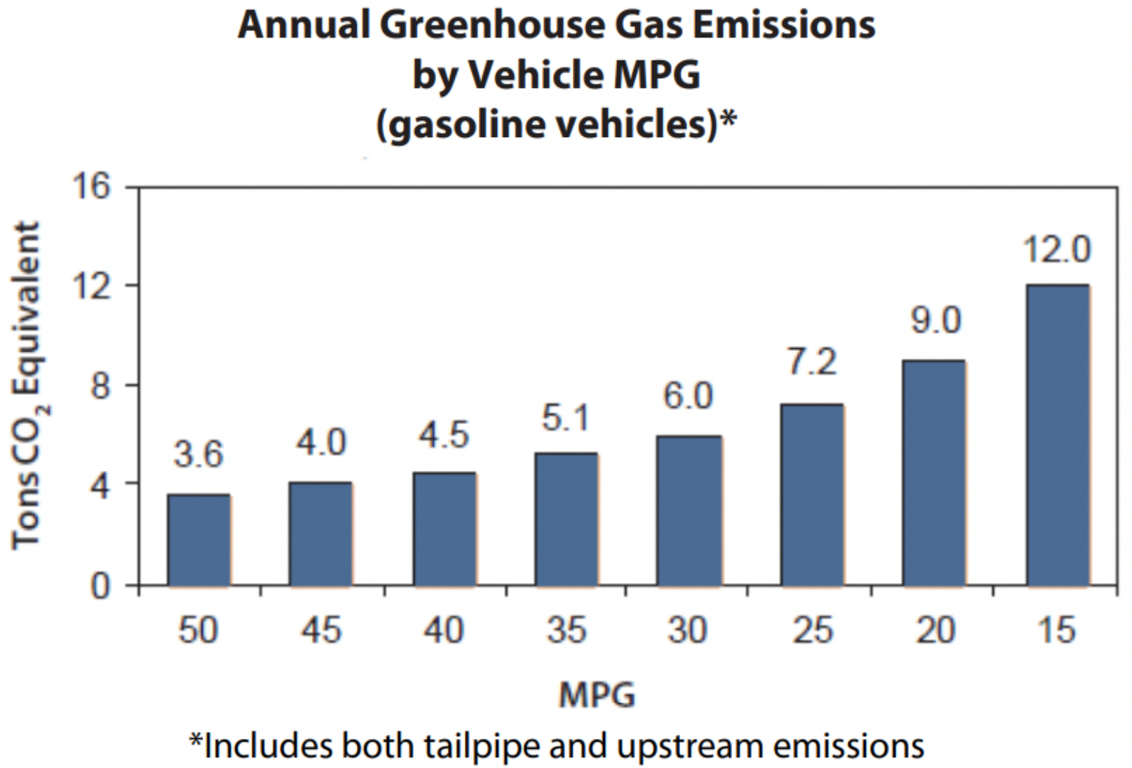
Fuel efficiency

- **city08** - city Miles Per Gallon (MPG)
- **highway08** - highway MPG
- **comb08** - Miles Per Gallon (MPG), combined over different driving conditions.
- **barrels08** - annual petroleum consumption in barrels
- **fuelCost08** - annual fuel cost

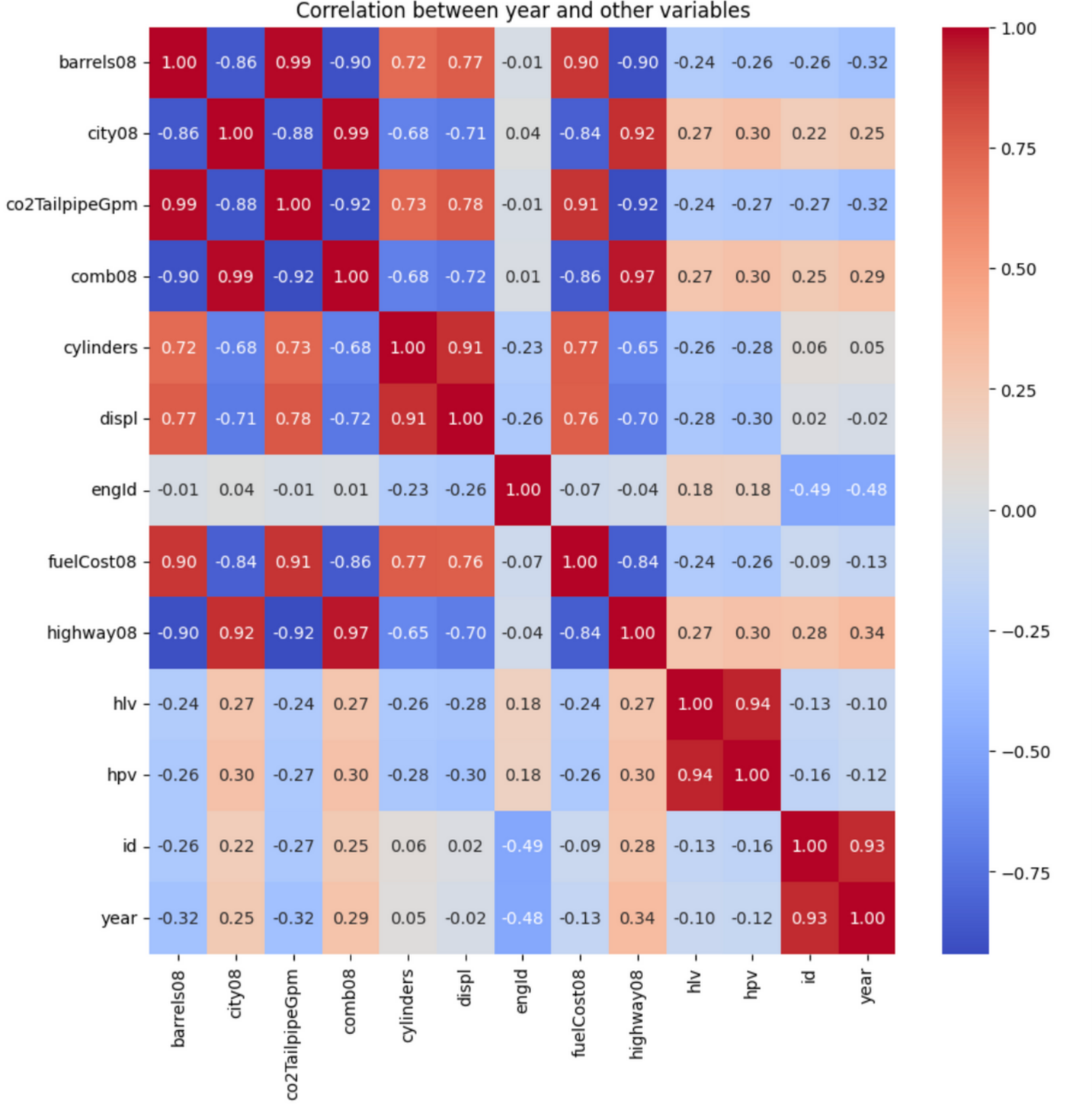
Findings

The amount of CO2 a car emits is directly related to the amount of fuel it consumes (2023).





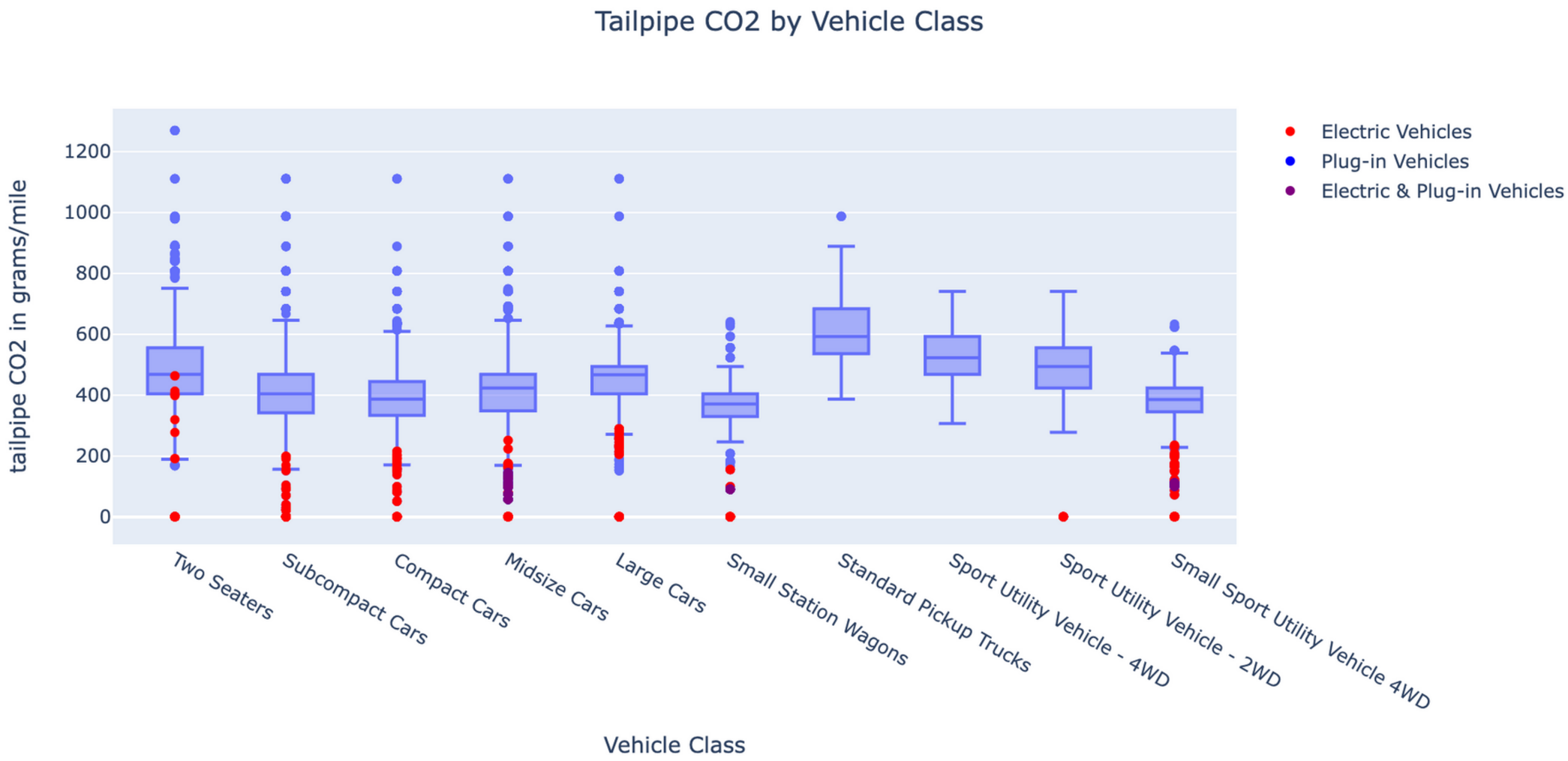
"Switching from a vehicle that gets 20 miles per gallon (MPG) to one that gets 25 MPG can reduce GHG emissions by 1.7 tons per year. Switching to an electric vehicle could reduce your GHG emissions even more. (2023)"


Correlation between year and other variables
barrels08 1.00 -0.86 0.99 -0.90 0.72 0.77 -0.01 0.90 -0.90 -0.24 -0.26 -0.26 -0.32
city08 -0.86 1.00 -0.88 0.99 -0.68 -0.71 0.04 -0.84 0.92 0.27 0.30 0.22 0.25
co2TailpipeGpm 0.99 -0.88 1.00 -0.92 0.73 0.78 -0.01 0.91 -0.92 -0.24 -0.27 -0.27 -0.32
comb08 -0.90 0.99 -0.92 1.00 -0.68 -0.72 0.01 -0.86 0.97 0.27 0.30 0.25 0.29
cylinders 0.72 -0.68 0.73 -0.68 1.00 0.91 -0.23 0.77 -0.65 -0.26 -0.28 0.06 0.05
displ 0.77 -0.71 0.78 -0.72 0.91 1.00 -0.26 0.76 -0.70 -0.28 -0.30 0.02 -0.02
engId -0.01 0.04 -0.01 0.01 -0.23 -0.26 1.00 -0.07 -0.04 0.18 0.18 -0.49 -0.48
fuelCost08 0.90 -0.84 0.91 -0.86 0.77 0.76 -0.07 1.00 -0.84 -0.24 -0.26 -0.09 -0.13
highway08 -0.90 0.92 -0.92 0.97 -0.65 -0.70 -0.04 -0.84 1.00 0.27 0.30 0.28 0.34
hlv -0.24 0.27 -0.24 0.27 -0.26 -0.28 0.18 -0.24 0.27 1.00 0.94 -0.13 -0.10
hpv -0.26 0.30 -0.27 0.30 -0.28 -0.30 0.18 -0.26 0.30 0.94 1.00 -0.16 -0.12
id -0.26 0.22 -0.27 0.25 0.06 0.02 -0.49 -0.09 0.28 -0.13 -0.16 1.00 0.93
year -0.32 0.25 -0.32 0.29 0.05 -0.02 -0.48 -0.13 0.34 -0.10 -0.12 0.93 1.00
barrels08
city08
co2TailpipeGpm
comb08
cylinders
displ
engId
fuelCost08
highway08
hlv
hpv
id
year
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75

Plot 1

INSIGHTS

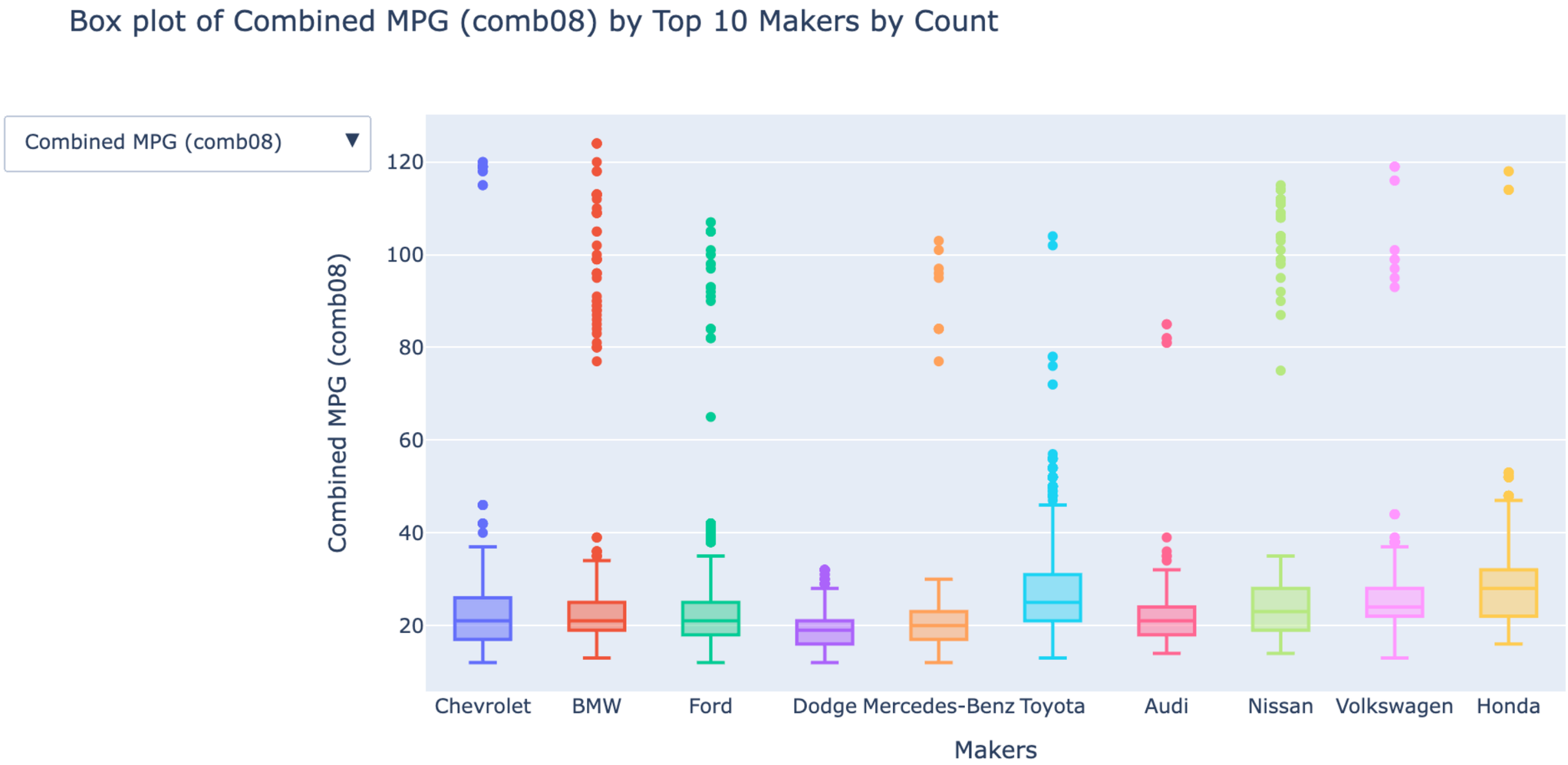
- Larger vehicles tend to emit more CO2.
- Variations between vehicle classes are not as significant.
- The prominence of electricity usage often outweighs the impact of the vehicle's class on CO2 emissions.



Plot 2

INSIGHTS

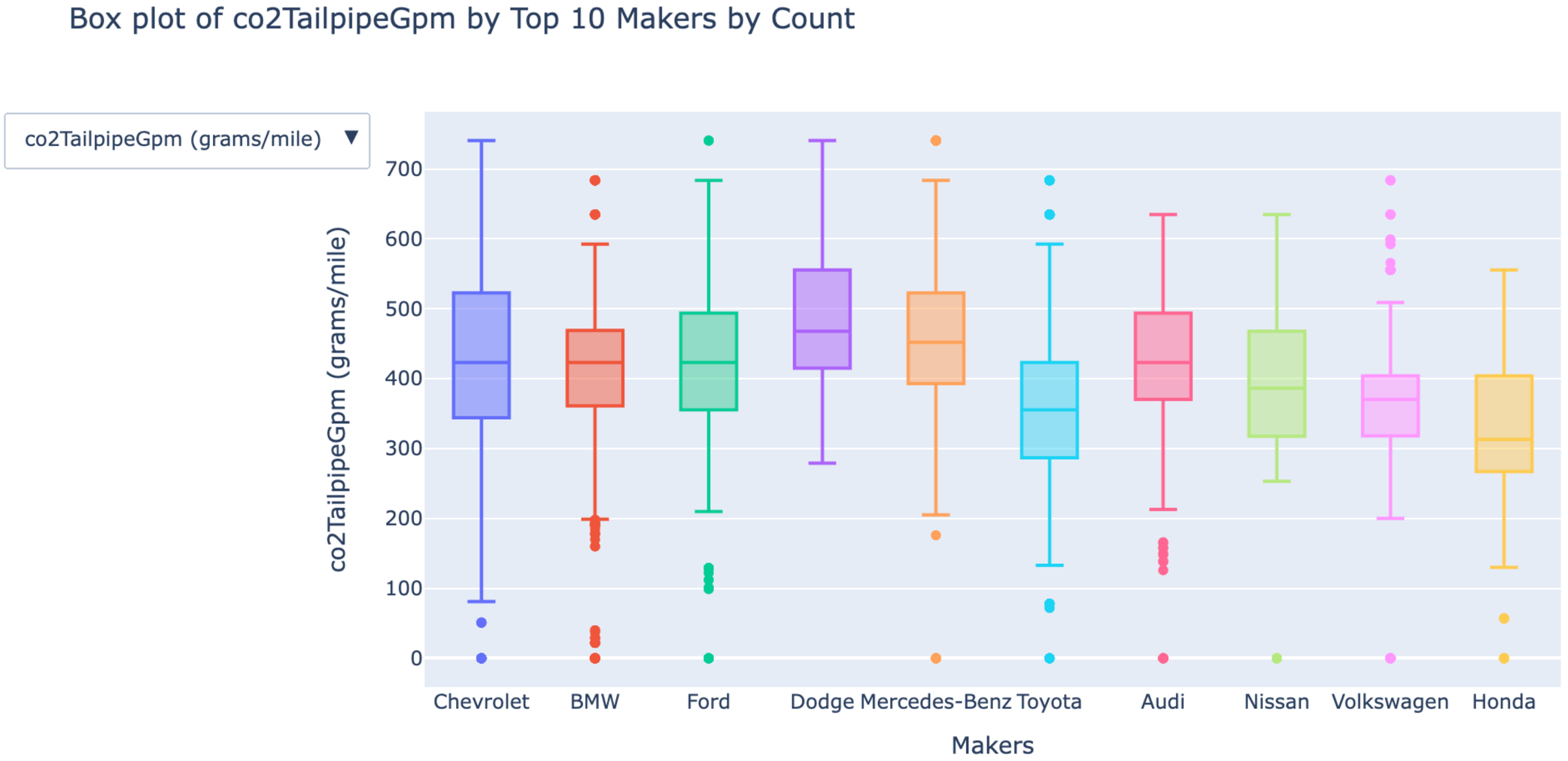
- The differences in MPG and CO2 emissions among vehicle makers are not pronounced.
- (Outliner) The jump in fuel efficiency is largely attributed to the integration of innovative technologies and the adoption of electric vehicle platforms.
- However, the older or more traditional models, the majority, drag down the overall landscape of the performance of MPG



Plot 2

INSIGHTS

- The average tailpipe CO2 emission falls between 400 and 600 (grams/mile)
- The vehicle makers having more diverse and are more willing to adopt new technology, such as Toyota and BMW, perform better in cutting CO2 emission
- The low performers are old MK, whereas the high achievers are mostly EVs



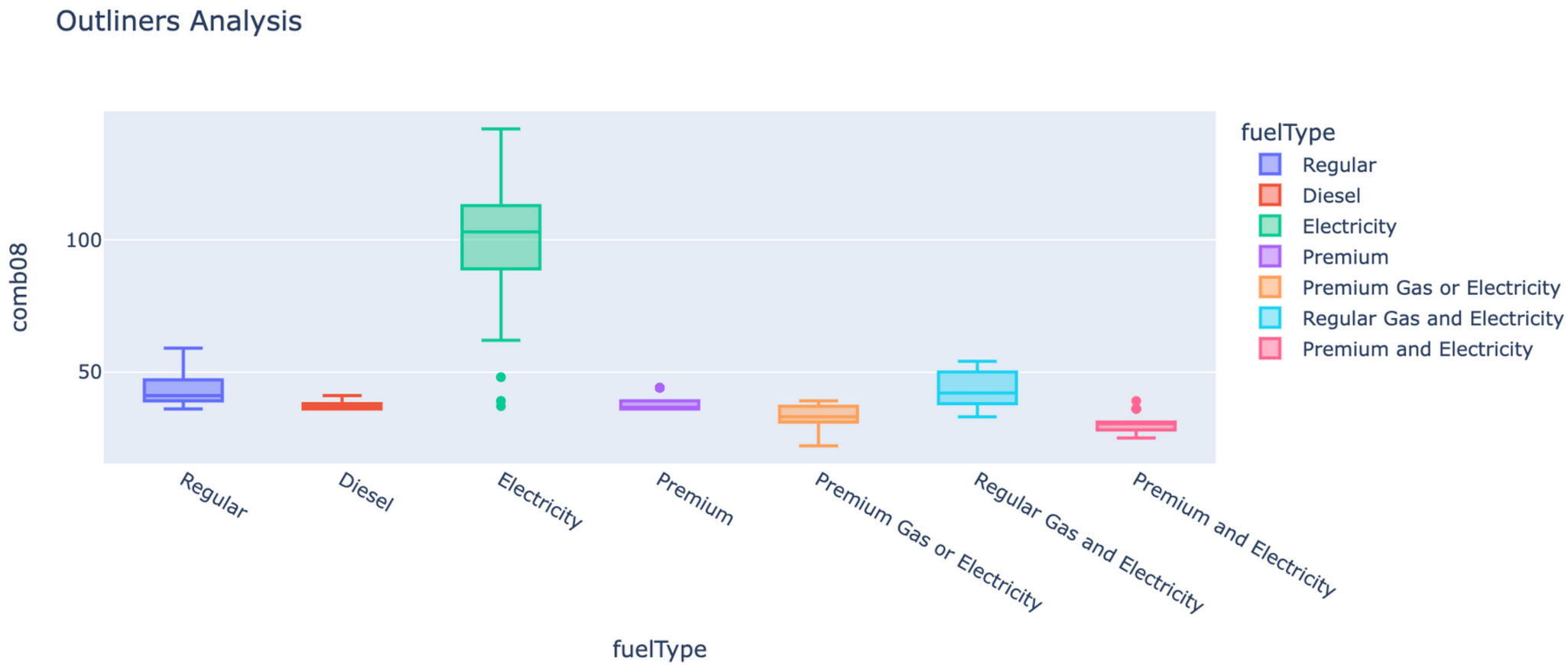
Plot 3

Outliner Analysis Insights

- Electricity or half electricity-powered vehicles perform significantly in CO2 emission and fuel economy than traditional petrol or diesel-powered ones.
- CO2: Diesel > Regular > Premium > Premium & electricity > Regular & electricity > Premium or electricity

Select Y-axis Variable:

comb08



***Outliners
CO2 < lower fence
MPG > higher fence

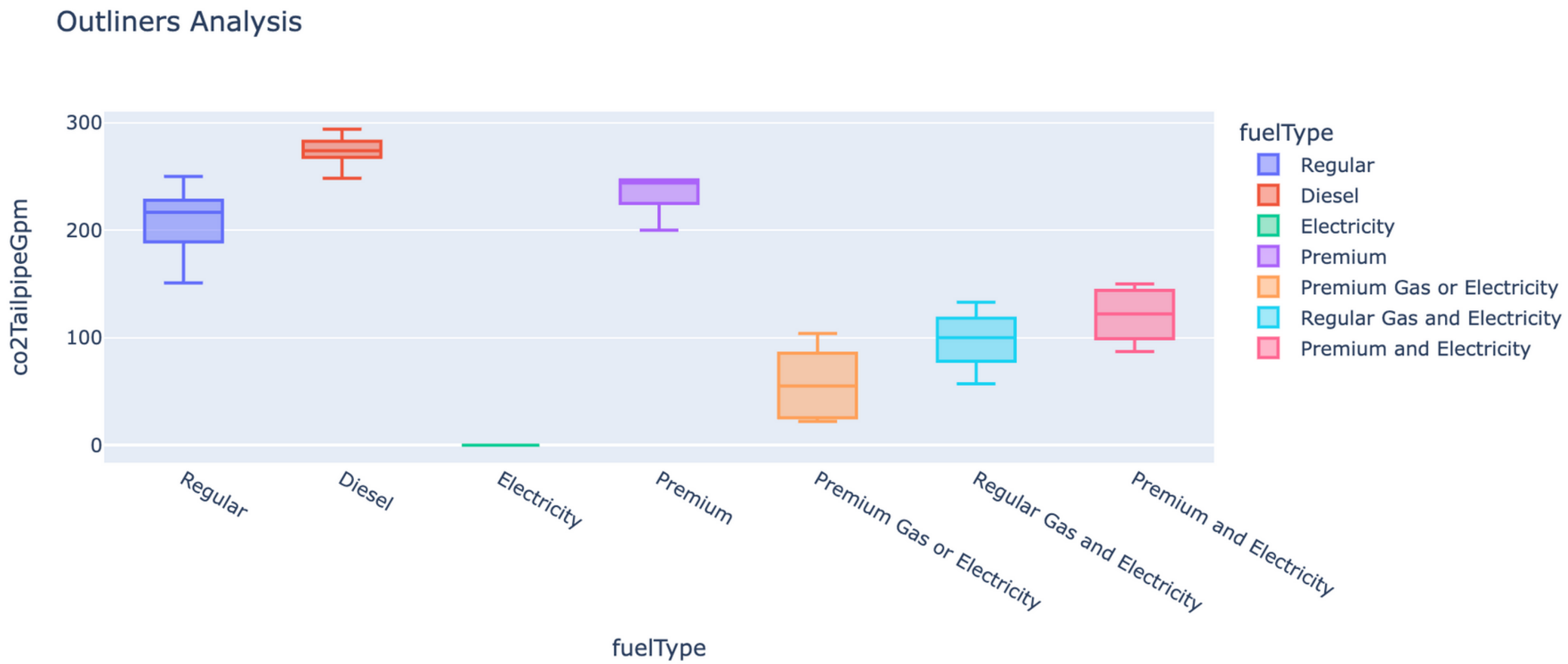
Plot 3

Outliner Analysis Insights

- Electricity or half electricity-powered vehicles perform significantly in CO2 emission and fuel economy than traditional petrol or diesel-powered ones.
- CO2: Diesel > Regular > Premium > Premium & electricity > Regular & electricity > Premium or electricity

Select Y-axis Variable:

co2TailpipeGpm



Recommended Strategies

Encourage the adoption of EVs

Infrastructure Investment
Upgrade the electrical grid
Implement EV charging infrastructure

Purchase Incentives
Offer tax credits to EV buyers
Launch trade-in programs for older vehicles

Upgrade older vehicles

Retrofitting
Collaborate with manufacturers to develop retrofit kits.

Fuel Switching
Provide incentives for gas stations to offer alternative, cleaner fuels such as biofuels.

Shortcomings

Shortcoming of the data

The selection of the variables might not be comprehensive enough to analyse CO2 emissions

The data selected might be underrepresented overrepresented the original data, which might be due to the lack of volume and quality of data

Shortcoming of my analysis

The economic implications, such as fuel cost, have not been sufficiently explored.

This analysis focus on primarily on a snapshot in time instead of the trends overtime

Party rotation and other political issues will greatly influence the progress of the strategies

References

CO2 emissions and fuel consumption: what is the link? (n.d.). WLTPfacts.eu. https://www.wltpfacts.eu/link-between-co2-emissions-fuel-consumption/

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