Building Stations & Offering Electric Vehicles

A Study in Data Science for Porsche
by Team Tree Huggers

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95% more electric vehicles

were sold on average per state in 2018 compared to 2017!

While California accounts for almost half of those sales, only 92 were sold in the state of Wyoming. Vermont's electric vehicle sales and market shrank from 2017 to 2018. The numbers vary widely from state to state, and this study in data science aims to help Porsche to determine critical information on electric vehicles and stations in the US.

1. Station Locations

Determining the ideal locations for new electric charging infrastructure means finding the locations with growing demand for electric vehicles and a need for more stations.

➔ **Lower Station Count**

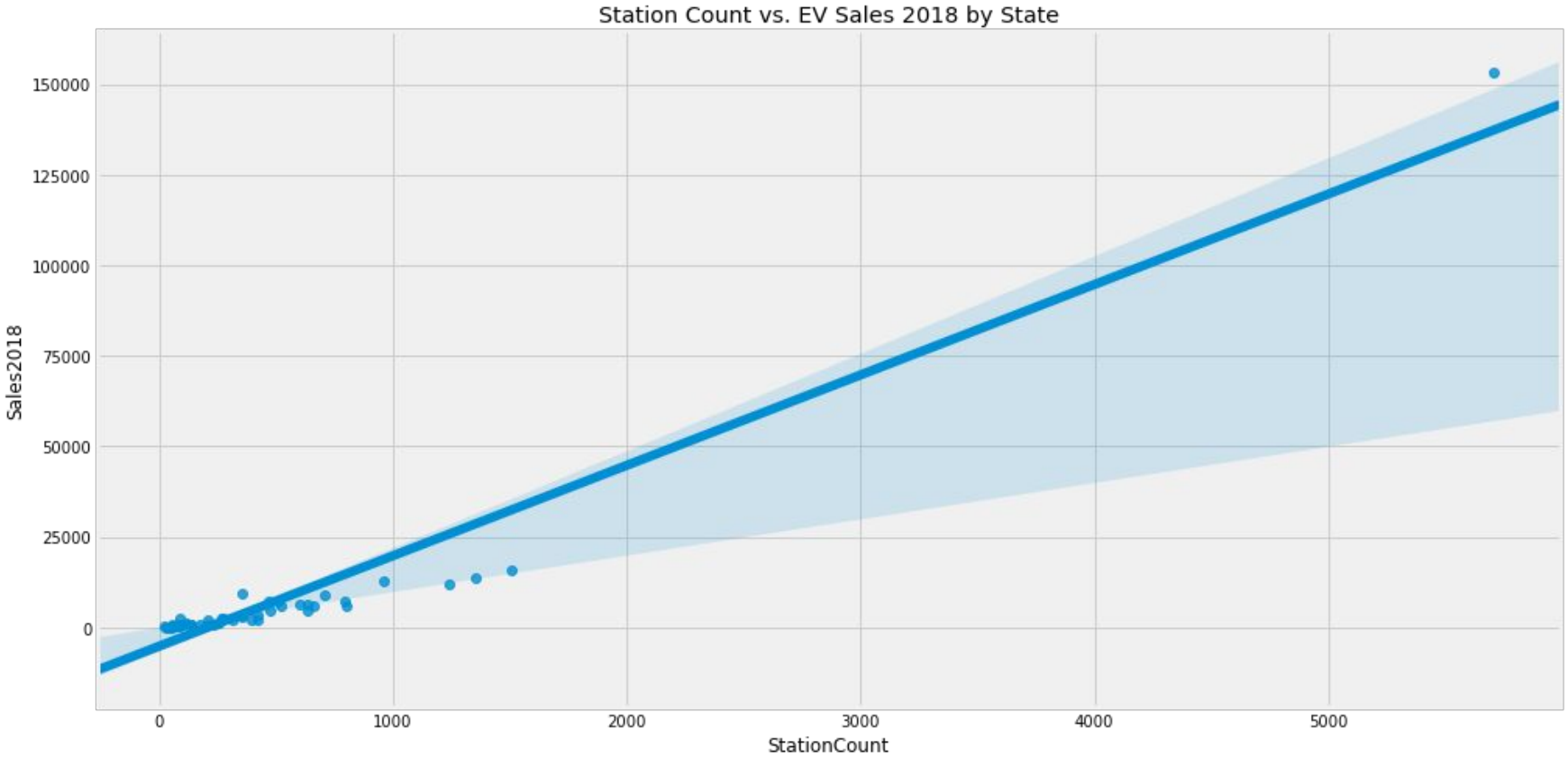
The states with number of electric charging stations under the 75th percentile were found using the station count by state dataset .

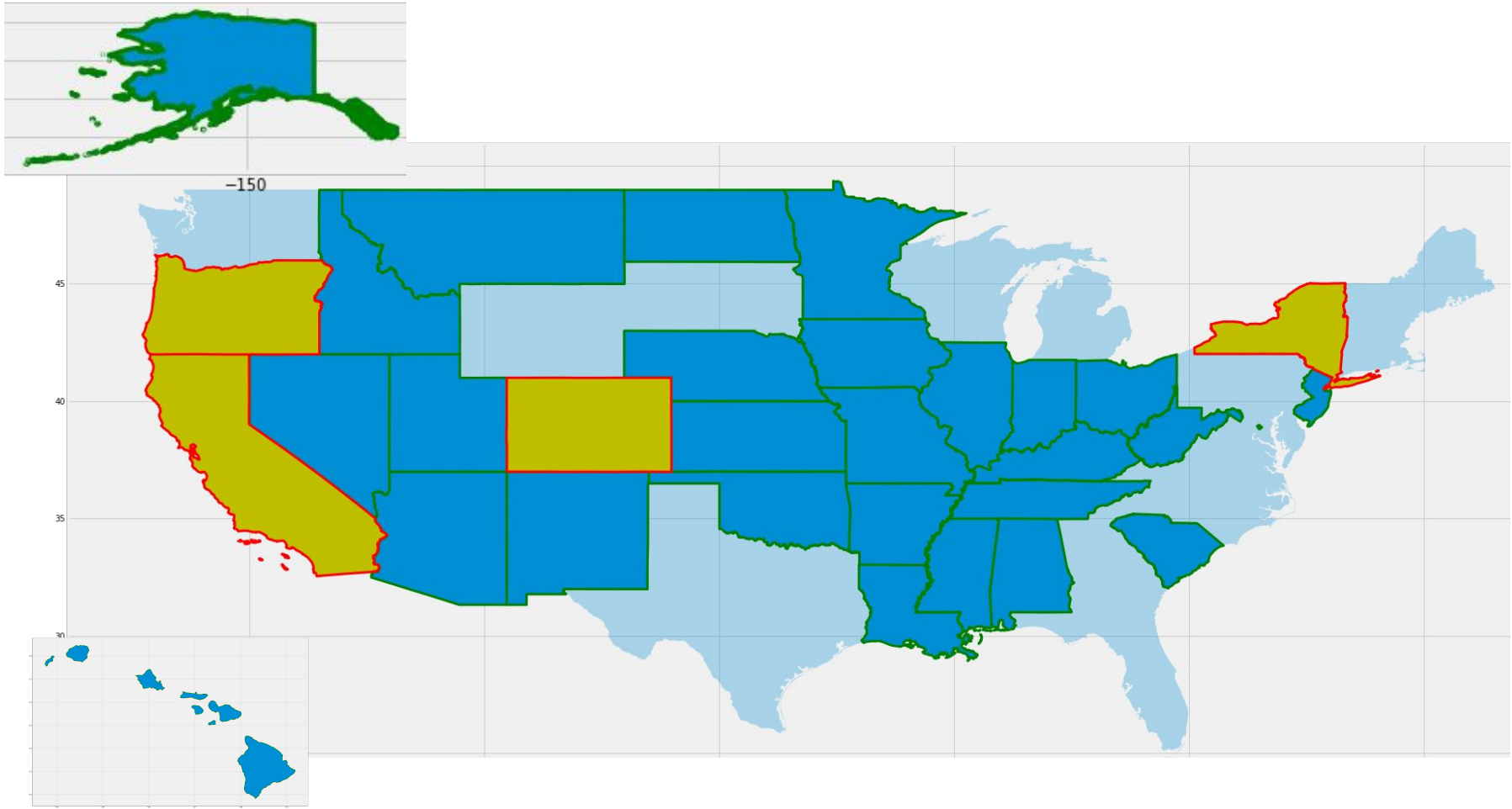
➔ **Higher EV Sales & Market Share Increase**

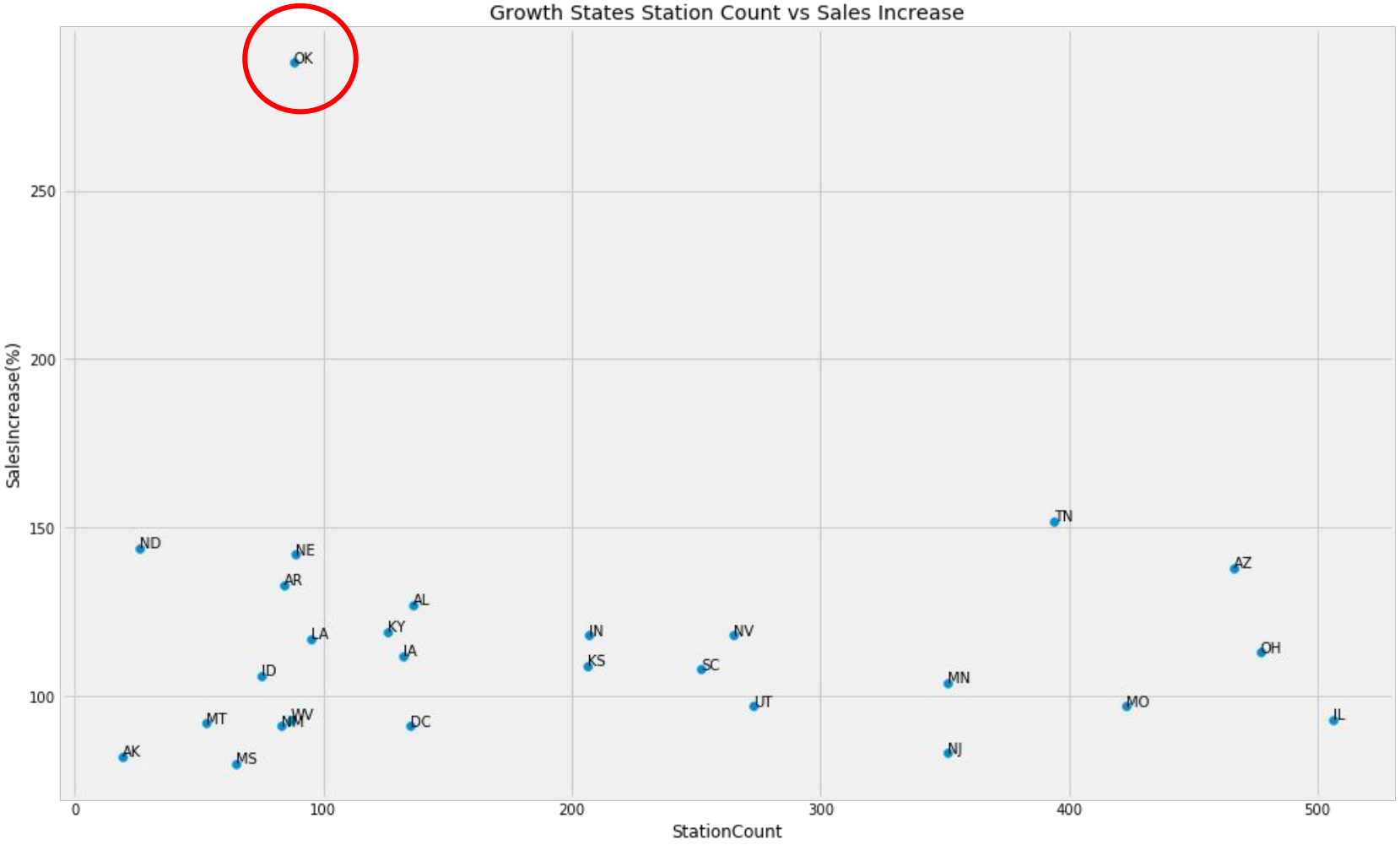
The states with EV sales and market share increase above the 25th percentile were found using the EV market share by state dataset.

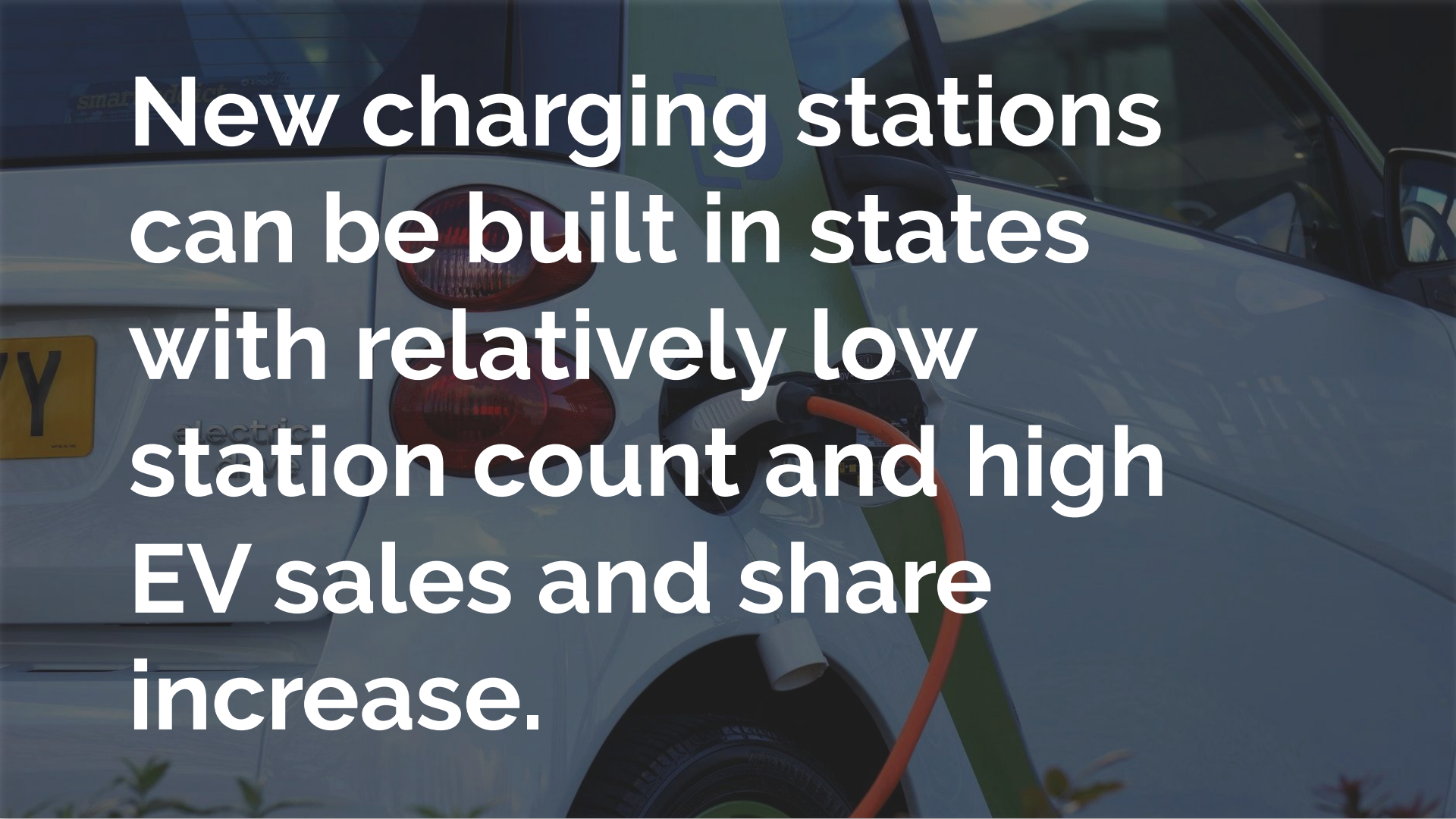
Where should we go to invest in new electric charging infrastructure?

Anywhere but California! :)


Station Count vs. EV Sales 2018 by State
150000
125000
100000
75000
50000
25000
0
Sales2018
0
1000
2000
3000
4000
5000
StationCount


−150
45
40
35
30


Growth States Station Count vs Sales Increase
SalesIncrease(%)
StationCount
250
200
150
100
0
100
200
300
400
500
OK
ND
NE
AR
AL
LA
KY
IA
ID
IN
KS
NV
SC
UT
MN
NJ
TN
AZ
OH
MO
IL
MT
WV
NM
DC
AK
MS


New charging stations can be built in states with relatively low station count and high EV sales and share increase.

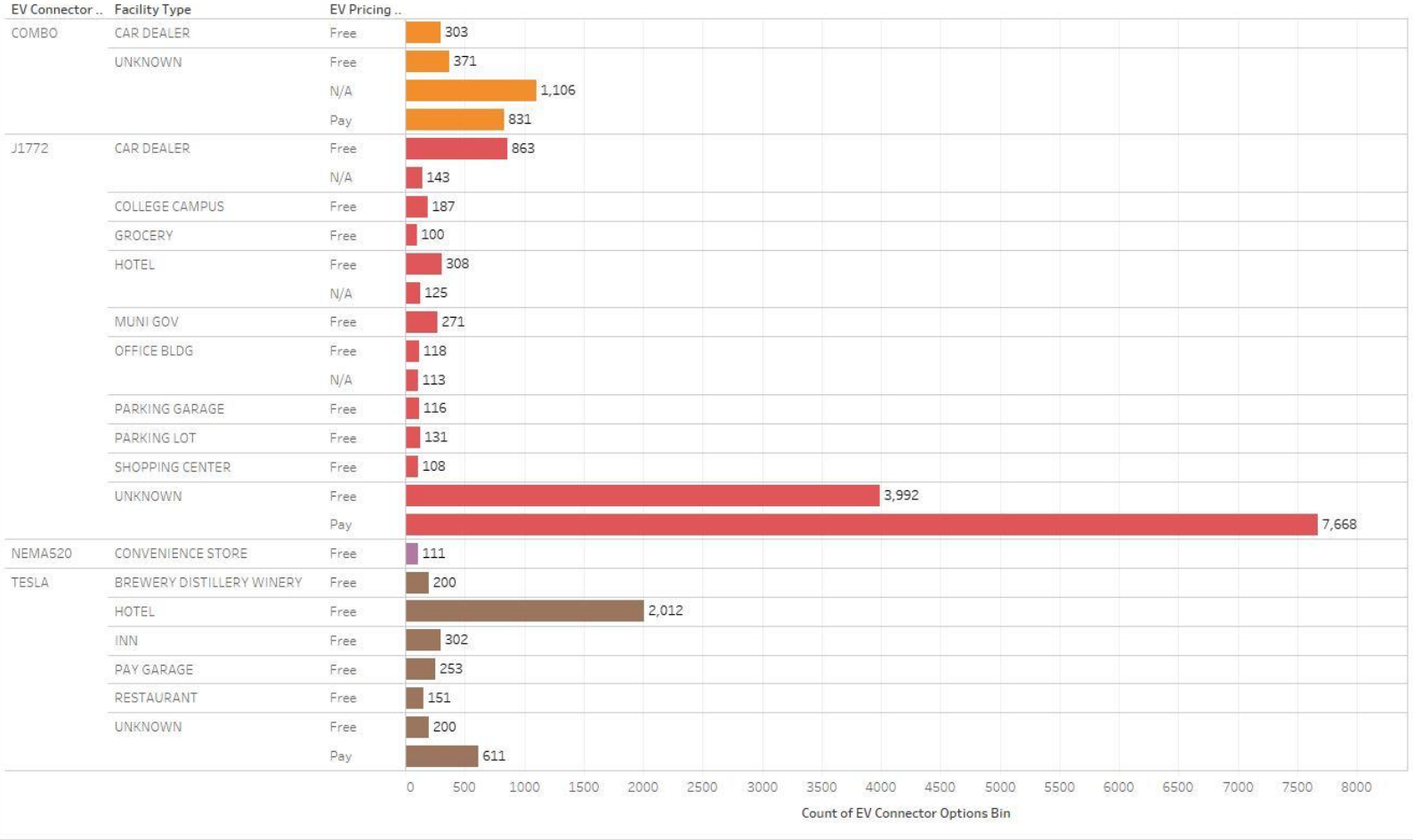
2. Station Attributes

Determining the attributes of charging stations to invest in means exploring the station attributes by location and comparing the attributes between places of differing electric vehicle demand.

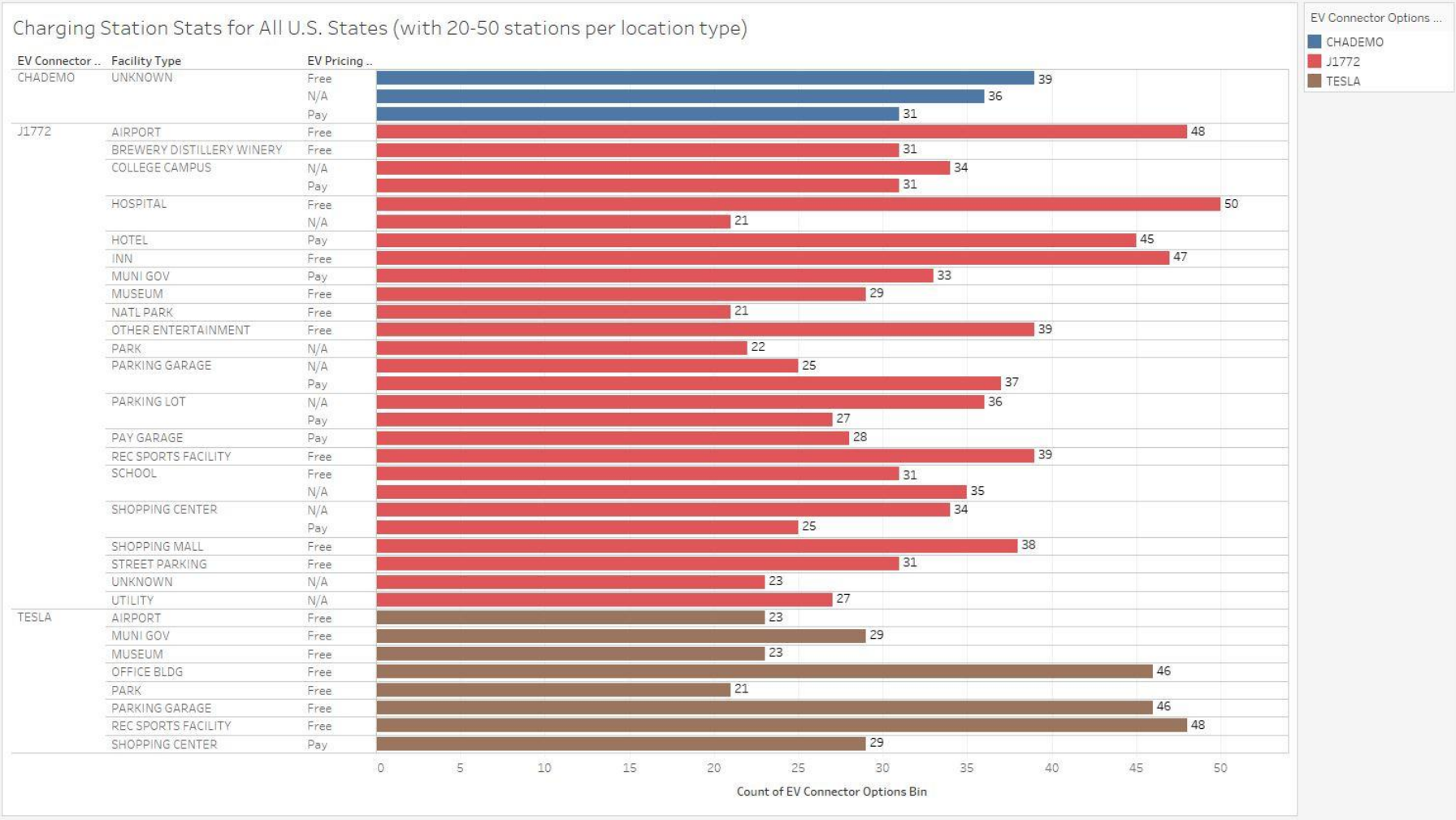
➔ **Station Attributes**

Visual and statistical analysis are performed on station attributes using the state-specific alternative fueling station locations dataset.

Charging Station Stats for All U.S. States (with 100 or more stations per location type)

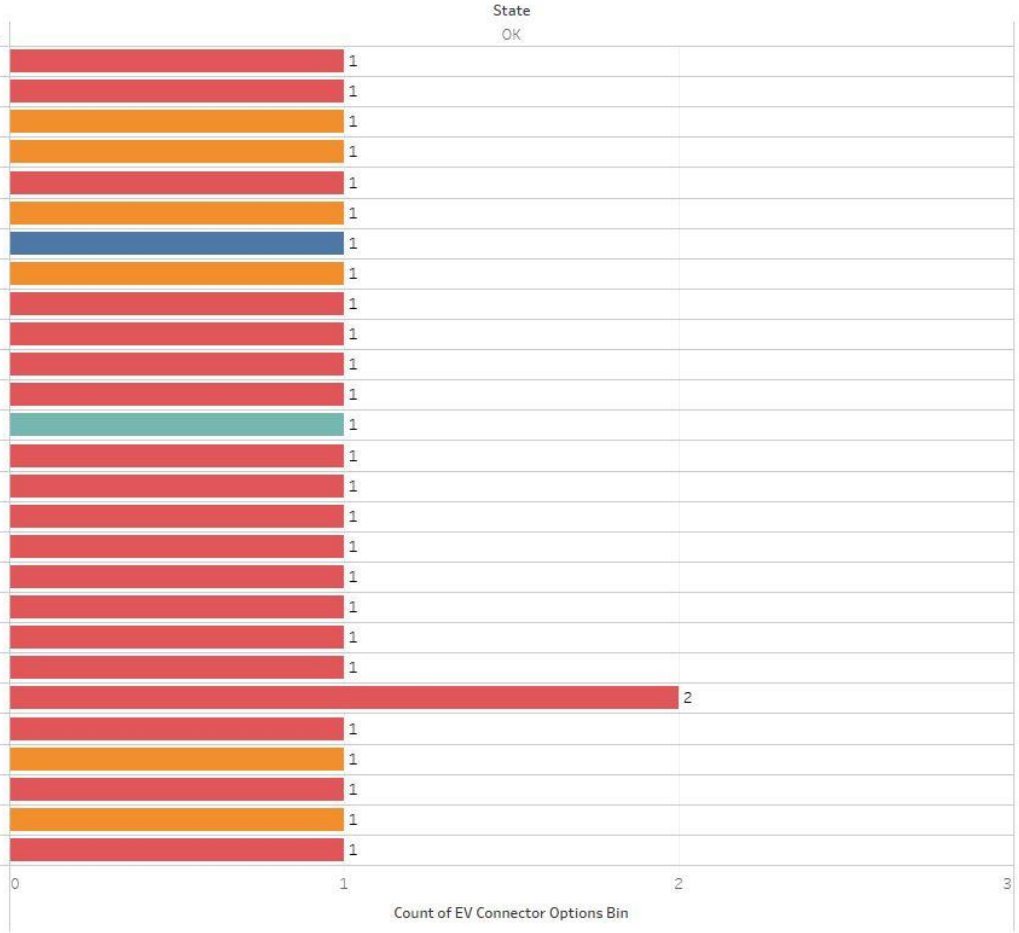


Charging Station Stats for All U.S. States (with 20-50 stations per location type)



Current Stats for Charging Stations in the Zip Codes with the Highest Demand in Oklahoma

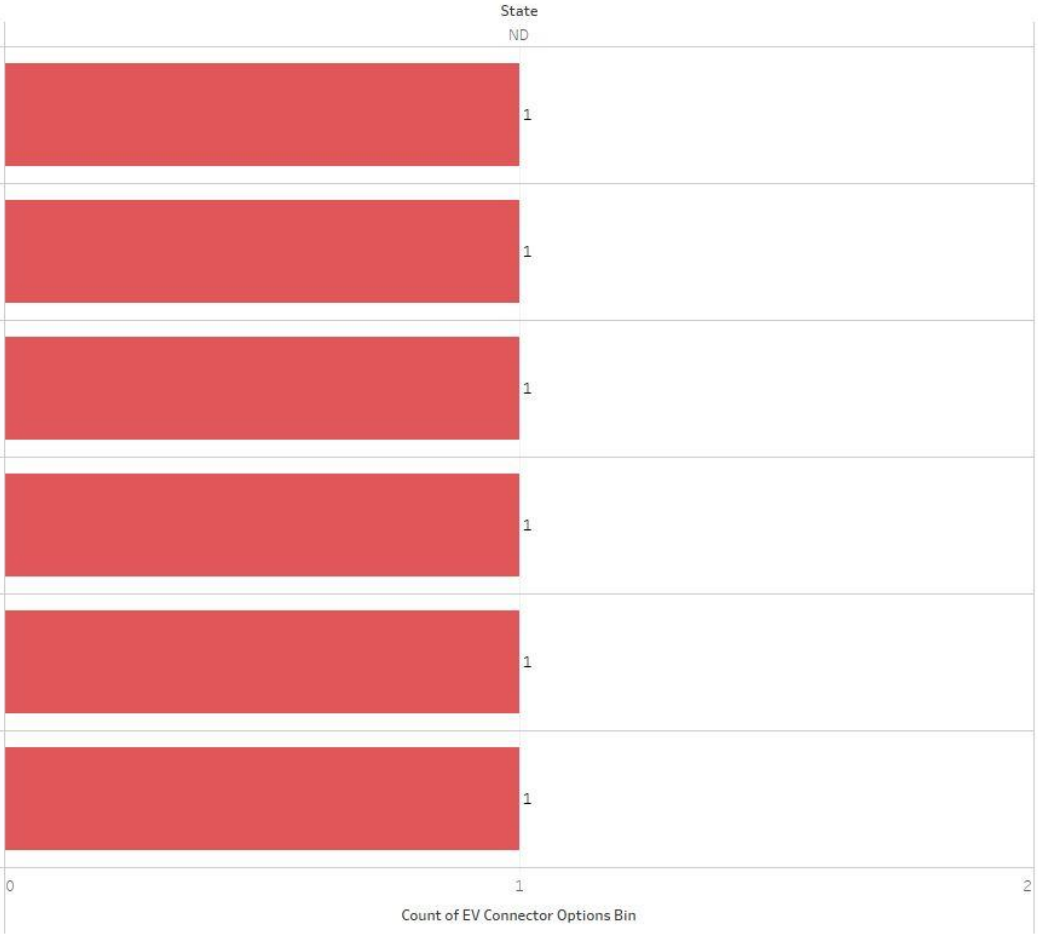
ZIP	City	EV Connector ..	Facility Type	EV Pricing ..
73013	Edmond	J1772	UNKNOWN	Free
73072	Norman	J1772	CAR DEALER	Free
73102	Oklahoma City	COMBO	HOTEL	Free
73114	Oklahoma City	COMBO	CAR DEALER	Free
73115	Del City	J1772	CAR DEALER	Free
73118	Oklahoma City	COMBO	UNKNOWN	Free
73127	Oklahoma City	CHADEMO	OFFICE BLDG	Free
73149	Oklahoma City	COMBO	CAR DEALER	Free
73162	Oklahoma City	J1772	CAR DEALER	Free
73401	Ardmore	J1772	CAR DEALER	Free
73644	Elk City	J1772	CAR DEALER	Free
73705	Enid	J1772	UNKNOWN	Free
73801	Woodward	NEMA1450	CARWASH	N/A
74008	Bixby	J1772	GROCERY	Free
74012	Broken Arrow	J1772	CAR DEALER	Free
74103	Tulsa	J1772	LIBRARY	Free
			PARKING GARAGE	Free
74104	Tulsa	J1772	UNKNOWN	Free
74107	Tulsa	J1772	CAR DEALER	Free
74115	Tulsa	J1772	AIRPORT	Free
74129	Tulsa	J1772	CAR DEALER	Free
74133	Tulsa	J1772	CAR DEALER	Free
			UNKNOWN	Free
74137	Tulsa	COMBO	UNKNOWN	Free
74401	Muskogee	J1772	CAR DEALER	Free
74441	Hulbert	COMBO	UNKNOWN	Pay
74501	McAlester	J1772	CAR DEALER	Free



EV Connector Options ...
- CHADEMO
- COMBO
- J1772
- NEMA1450

Current Stats for Charging Stations in the Zip Codes with the Highest Demand in North Dakota

ZIP	City	EV Connector ..	Facility Type	EV Pricing ..
58078	West Fargo	J1772	HOTEL	Free
58103	Fargo	J1772	CAR DEALER	Free
58104	Fargo	J1772	SHOPPING CENTER	Free
58201	Grand Forks	J1772	CAR DEALER	Free
			HOTEL	Free
58401	Jamestown	J1772	CAR DEALER	Free



EV Connector Options ...
J1772

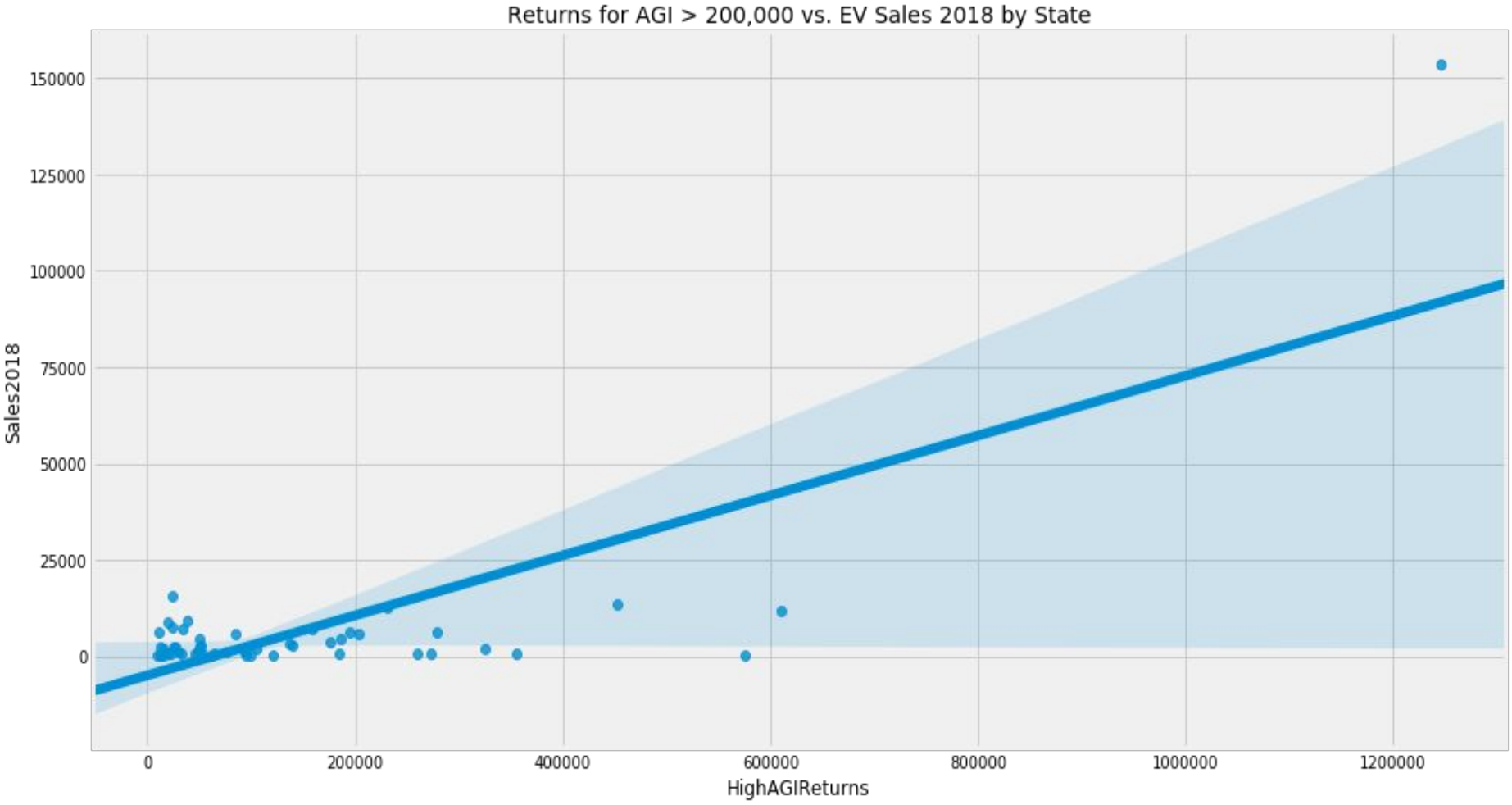
Opportunities exist to expand the network of existing charging stations in OK and ND.

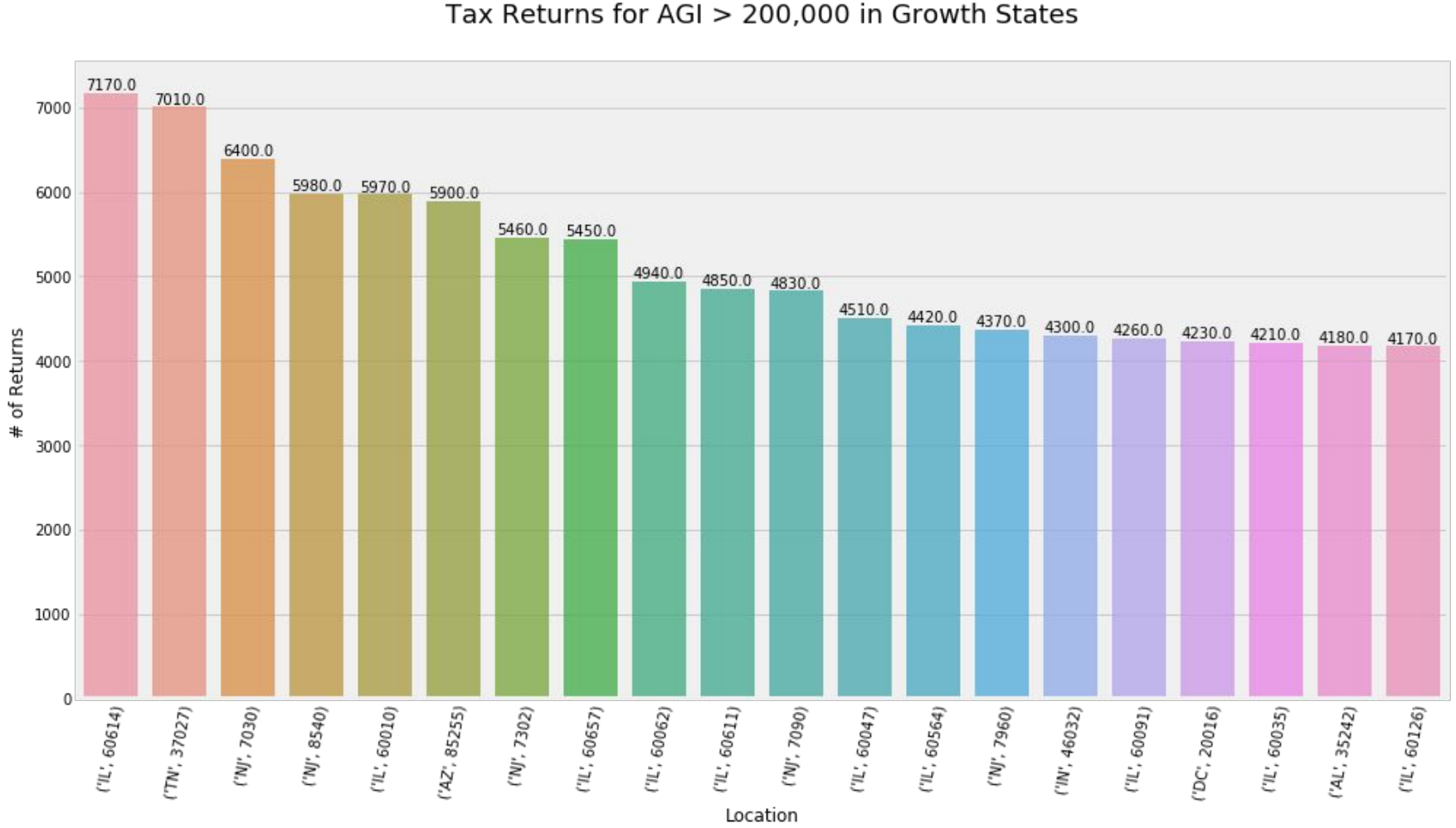
3. EV Offering Locations

Determining the ideal locations for rolling out Porsche's electric vehicle offering means finding those locations with consumers who can afford electric vehicles in the price range of a Porsche Taycan within those states of fastest growing demand for electric vehicles.

➔ **High Adjusted Gross Income**

The zip codes with the most number of tax returns for AGI above $200,000 within the states of growing EV demand were found using the individual income tax statistics dataset.


Returns for AGI > 200,000 vs. EV Sales 2018 by State
Sales2018
150000
125000
100000
75000
50000
25000
0
0
200000
400000
600000
800000
1000000
1200000
HighAGIReturns


Tax Returns for AGI > 200,000 in Growth States
# of Returns
Location
0
1000
2000
3000
4000
5000
6000
7000
7170.0
7010.0
6400.0
5980.0
5970.0
5900.0
5460.0
5450.0
4940.0
4850.0
4830.0
4510.0
4420.0
4370.0
4300.0
4260.0
4230.0
4210.0
4180.0
4170.0
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('TN', 37027)
('NJ', 7030)
('NJ', 8540)
('IL', 60010)
('AZ', 85255)
('NJ', 7302)
('IL', 60657)
('IL', 60062)
('IL', 60611)
('NJ', 7090)
('IL', 60047)
('IL', 60564)
('NJ', 7960)
('IN', 46032)
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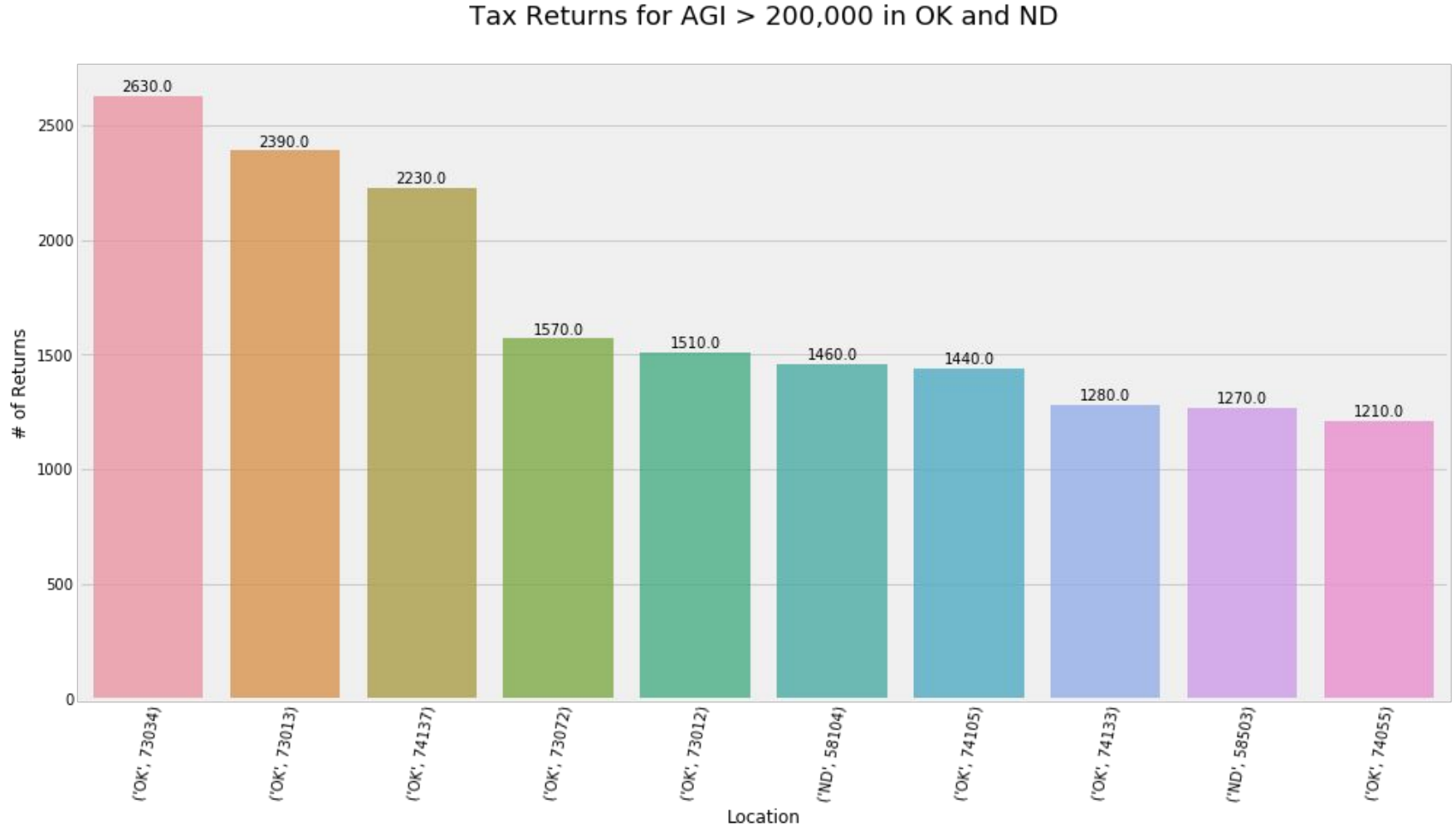
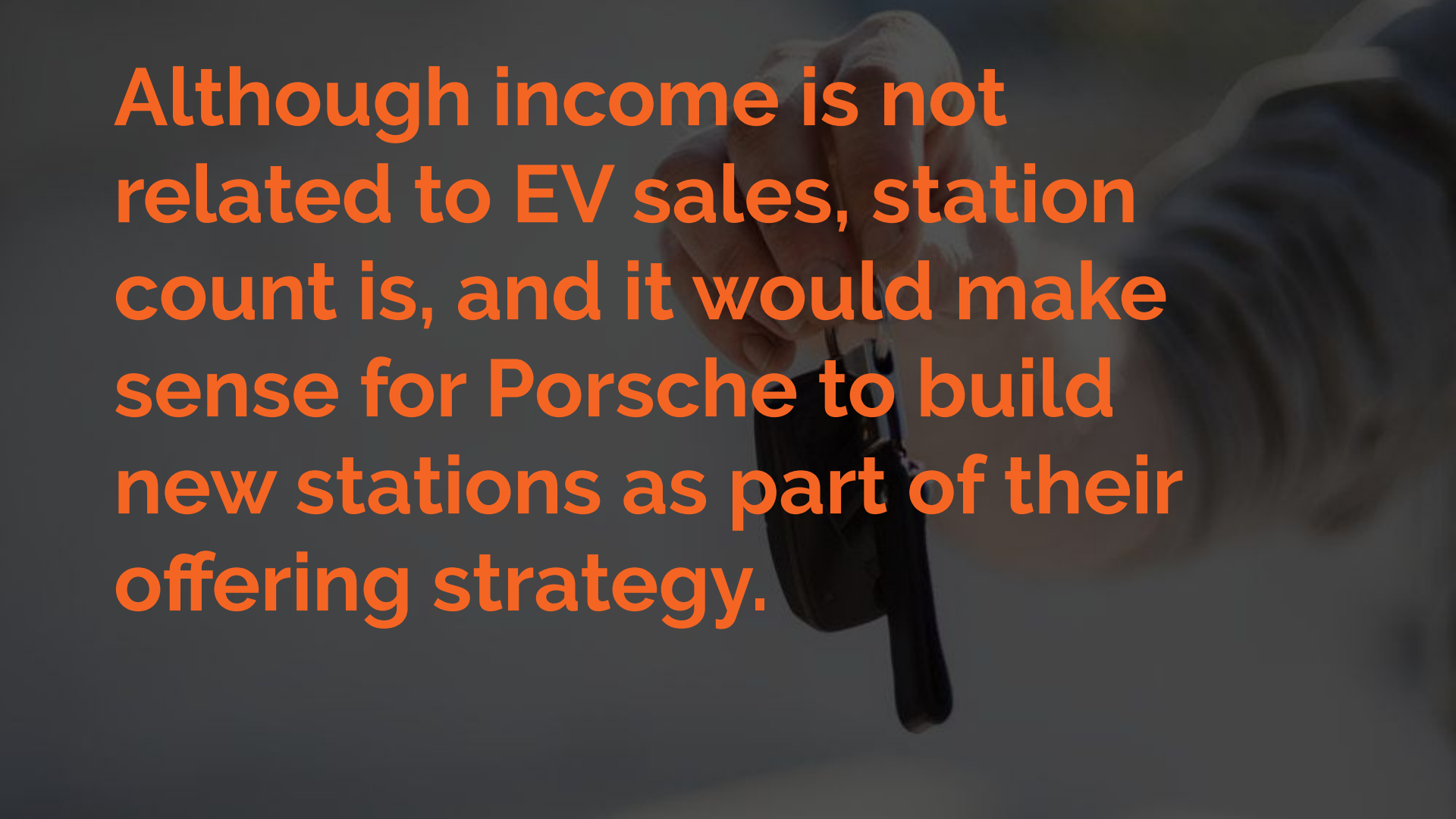
('DC', 20016)
('IL', 60035)
('AL', 35242)
('IL', 60126)


Tax Returns for AGI > 200,000 in OK and ND
# of Returns
Location
0
500
1000
1500
2000
2500
2630.0
2390.0
2230.0
1570.0
1510.0
1460.0
1440.0
1280.0
1270.0
1210.0
('OK', 73034)
('OK', 73013)
('OK', 74137)
('OK', 73072)
('OK', 73012)
('ND', 58104)
('OK', 74105)
('OK', 74133)
('ND', 58503)
('OK', 74055)



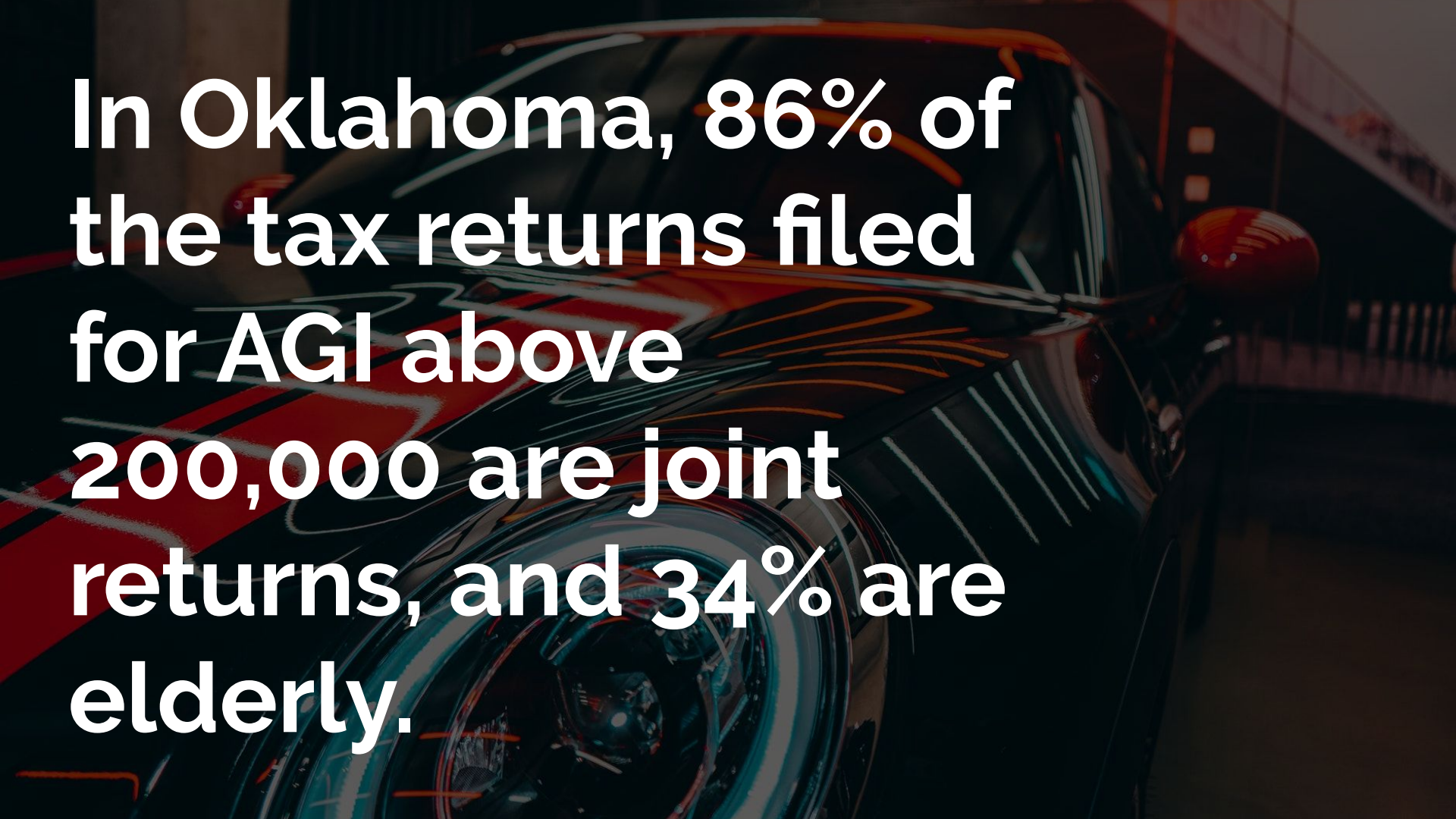
Although income is not related to EV sales, station count is, and it would make sense for Porsche to build new stations as part of their offering strategy.

4. EV Offering Demographics

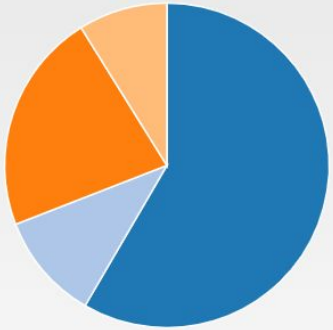
Profiling the potential customers of the Porsche Taycan means looking at the demographics of those zip codes with the most number of tax returns for AGI above $200,000 within the states of growing EV demand.

➔ **High AGI Demographics**

The consumer demographics are profiled with a combination of the individual income tax statistics dataset and the demographics by zip code dataset.

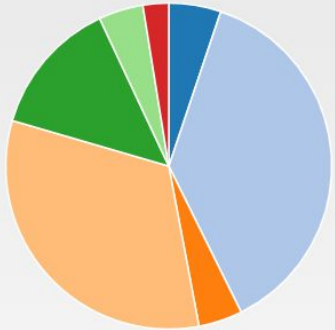

In Oklahoma, 86% of the tax returns filed for AGI above 200,000 are joint returns, and 34% are elderly.

Families vs Singles

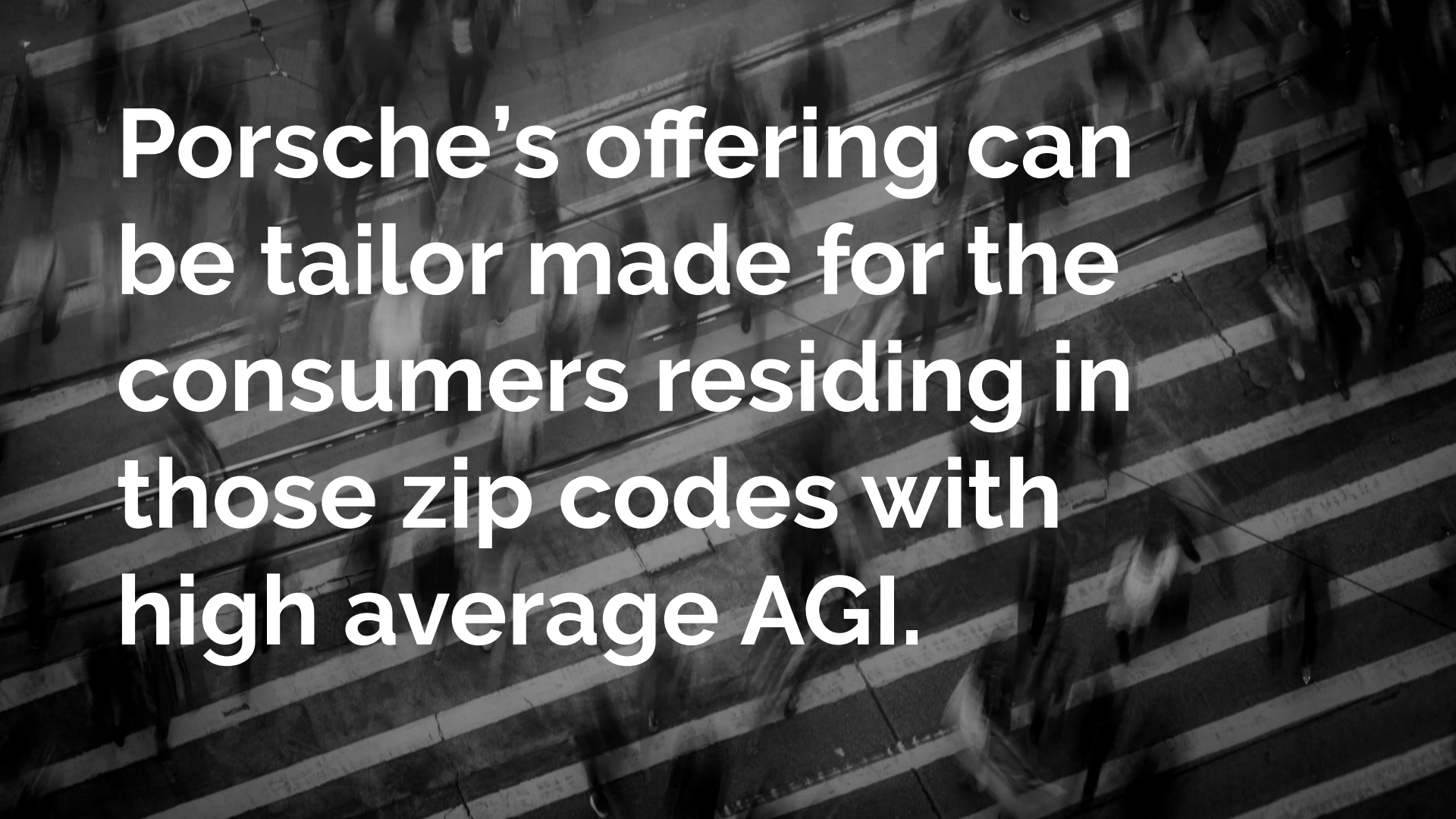


Husband Wife Family Households	8,866	58%
Single Guardian	1,623	11%
Singles	3,346	22%
Singles With Roommate	1,346	9%

Educational Attainment For The Population 25 Years And Over



Less than High School Diploma	1,333	5%
High School Graduate	9,666	38%
Associate's degree	1,122	4%
Bachelor's degree	8,372	32%
Master's degree	3,484	14%
Professional school degree	1,142	4%
Doctorate degree	656	3%


Porsche’s offering can be tailor made for the consumers residing in those zip codes with high average AGI.

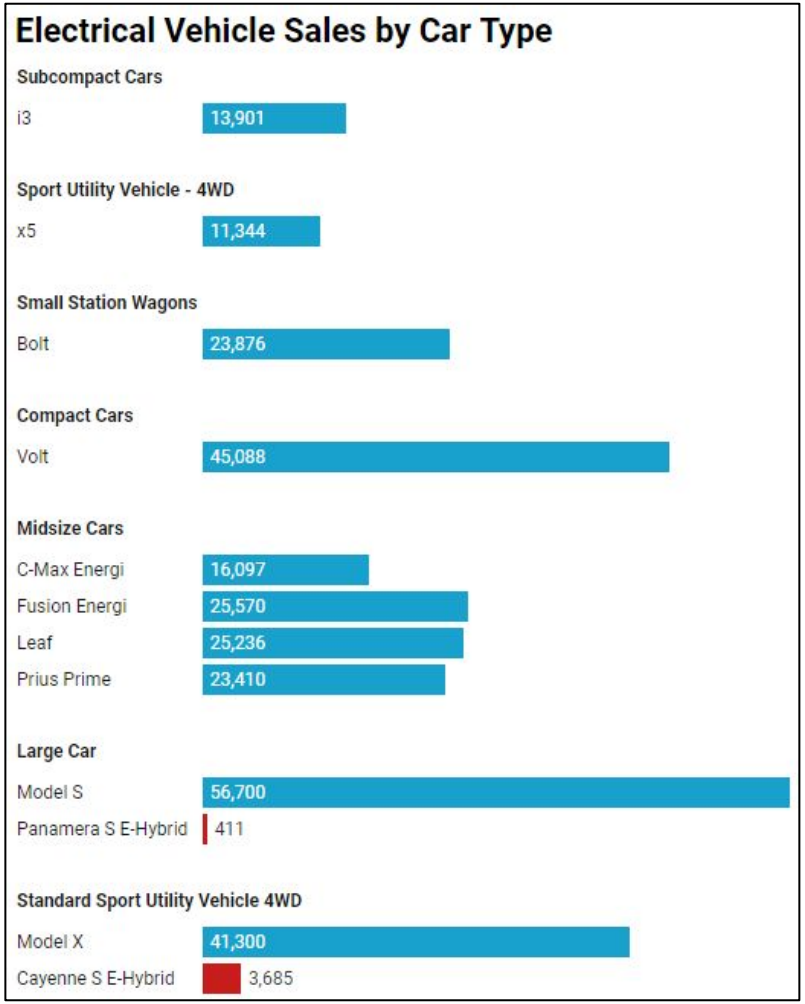
5. Vehicle Attributes

Determining the electric vehicle attributes ideal for Porsche's EV offering means looking at the vehicle models with high sales numbers and their attributes.

➔ **Vehicle Attributes of High Demand**

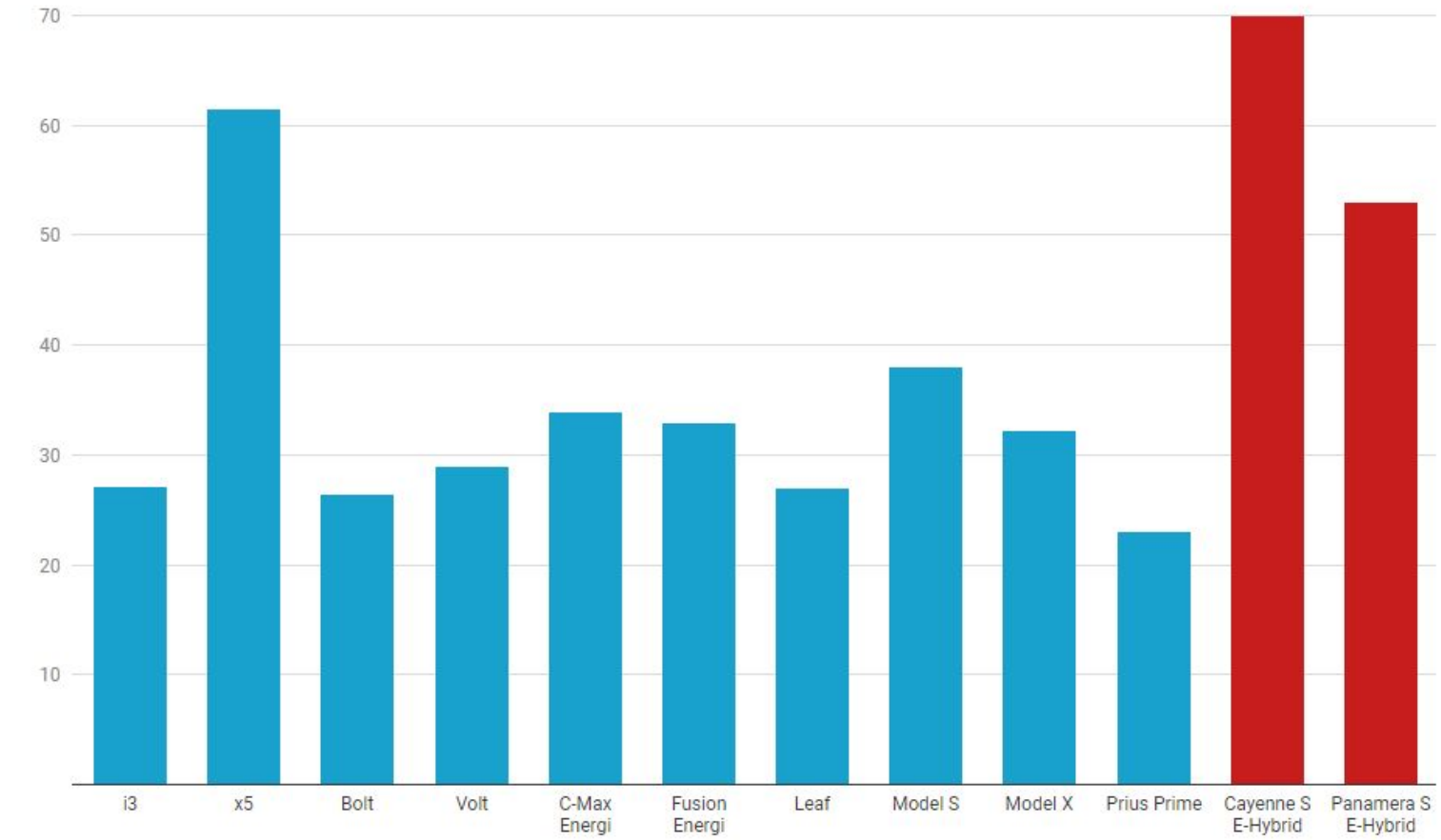
The vehicle attributes that contributed to the high sales figures of certain models were found with a combination of the EV sales by model dataset and the fuel economy dataset.

- Midsize EV market is more saturated and competitive.
- Compact EV leader, the Chevrolet Volt, is discontinued.
- Reduce energy consumption while capturing more of the electric vehicle market



Energy Consumption by Vehicle

cityE



Small car.

Big market share.

Summary

- Invest in new charging infrastructure in the states with low station count and high EV sales and share increase.
- Diversify the new infrastructure in these states:
  - Locations of varying types.
  - Locations with multiple types of charging outlets.
- Offer Porsche's new electric vehicle in zip codes with high average income in those states with low station count and high EV sales and share increase.
- Offer Porsche's new electric vehicle to those consumers with high AGI in those zip codes.
- Reduce energy consumption in current EVs.

Next Steps

- Refine station location analysis with station count over time by state.
- Test the hypothesis that Porsche customers have high earnings using Porsche customer data and adjust approach.
- Refine EV offering location analysis with Porsche sales data.
- Refine EV offering demographics analysis with Porsche customer data and sales data.
- Refine EV offering demographics analysis with paid access to full demographics by zip code database.
- Refine vehicle attributes analysis with sports car attributes data and Porsche sales data.

Thank You!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