EV Dynamics in Washington State - Initial Data Analysis

Ishaq Alalq Binyam Ali Jasmin Wilson

Data Quality Report – Electric Car Population

This dataset shows the Battery Electric Vehicles (BEVs) and Plug-in Hybrid Electric Vehicles (PHEVs) that are currently registered through Washington State Department of Licensing (DOL).

Numeric Data

	variable	n	missing	missing_pct	unique	unique_pct	mean	min	Q1	median	Q3	max	sd
1	Postal.Code	153830	3	0.001950205	820	0.53305597	9.817150e+04	1730	98052	98122	98370	99577	2.437224e+03
2	Model.Year	153830	0	0.000000000	22	0.01430150	2.020101e+03	1997	2018	2021	2023	2024	3.019617e+00
3	Electric.Range	153830	0	0.000000000	102	0.06630696	6.572767e+01	0	0	17	84	337	9.514722e+01
4	Base.MSRP	153830	0	0.000000000	31	0.02015212	1.273032e+03	0	0	0	0	845000	9.086044e+03
5	Legislative.District	153830	339	0.220373139	50	0.03250341	2.930256e+01	1	18	33	43	49	1.482851e+01
6	DOL.Vehicle.ID	153830	0	0.000000000	153830	100.00000000	2.124161e+08	4385	171309811	218327805	241506219	479254772	8.054800e+07
7	X2020.Census.Tract	153830	3	0.001950205	2073	1.34759150	5.297335e+10	1081041901	53033009500	53033029403	53053072601	56033000100	1.620212e+09

Factor Data

	variable	n	missing	missing_pct	unique	unique_pct	freqRatio	1st mode
1	City	153830	3	0.00195020477150101	685	0.445296756159397	3.35	Seattle
2	Clean.Alternative.Fuel.Vehicle..CAFV..Eligibility	153830	0	0	3	0.00195020477150101	1.16	Eligibility unknown as battery range has not been researched
3	County	153830	3	0.00195020477150101	179	0.116362218032893	4.55	King
4	Electric.Utility	153830	3	0.00195020477150101	76	0.0494051875446922	1.85	PUGET SOUND ENERGY INC||CITY OF TACOMA - (WA)
5	Electric.Vehicle.Type	153830	0	0	2	0.001300136514334	3.47	Battery Electric Vehicle (BEV)
6	Make	153830	0	0	37	0.0240525255151791	5.1	TESLA
7	Model	153830	0	0	127	0.0825586686602093	1.05	MODEL Y
8	State	153830	0	0	43	0.0279529350581811	1686.71	WA
9	Vehicle.Location	153830	7	0.00455047780016902	819	0.532405902619775	1.4	POINT (-122.12302 47.67668)
10	VIN..1.10.	153830	0	0	9671	6.28681011506208	1	7SAYGDEE6P

1st mode freq	2nd mode	2nd mode freq	least common	least common freq
26153	Bellevue	7810	Adairsville	1
72861	Clean Alternative Fuel Vehicle Eligible	62885	Not eligible due to low battery range	18084
80637	Snohomish	17727	Allen	1
56797	PUGET SOUND ENERGY INC	30622	BONNEVILLE POWER ADMINISTRATION||NESPELEM VALLEY...	1
119396	Plug-in Hybrid Electric Vehicle (PHEV)	34434	Plug-in Hybrid Electric Vehicle (PHEV)	34434
69601	NISSAN	13649	BENTLEY	1
29209	MODEL 3	27740	918	1
153491	CA	91	AK	1
3942	POINT (-122.1876761 47.820517)	2814	POINT (-104.50359 37.16543)	1
874	7SAYGDEE7P	871	1C4RJXR67R	1

Per the above report, we see that there are 3 missing values for Postal Code, Census, City, Country and Electric Utility. These missing values relate to owners of Electric Vehicle not in WA state or it is somewhere Electric Utility powergrid is not established. As they are very low in number and not causing much influence, we can ignore or remove these values safely.

Legislative District has 339 missing values. On further looking, these vehicles are not from owners from WA but from a different State. Since we are only interested in WA, we can safely remove this data as well.

```{r eval=TRUE}
filtered_data <- ev.data %>%
  filter(State != "WA") %>%
  select(VIN..1.10.,City,State,Legislative.District,Electric.Utility)

filtered_data
```

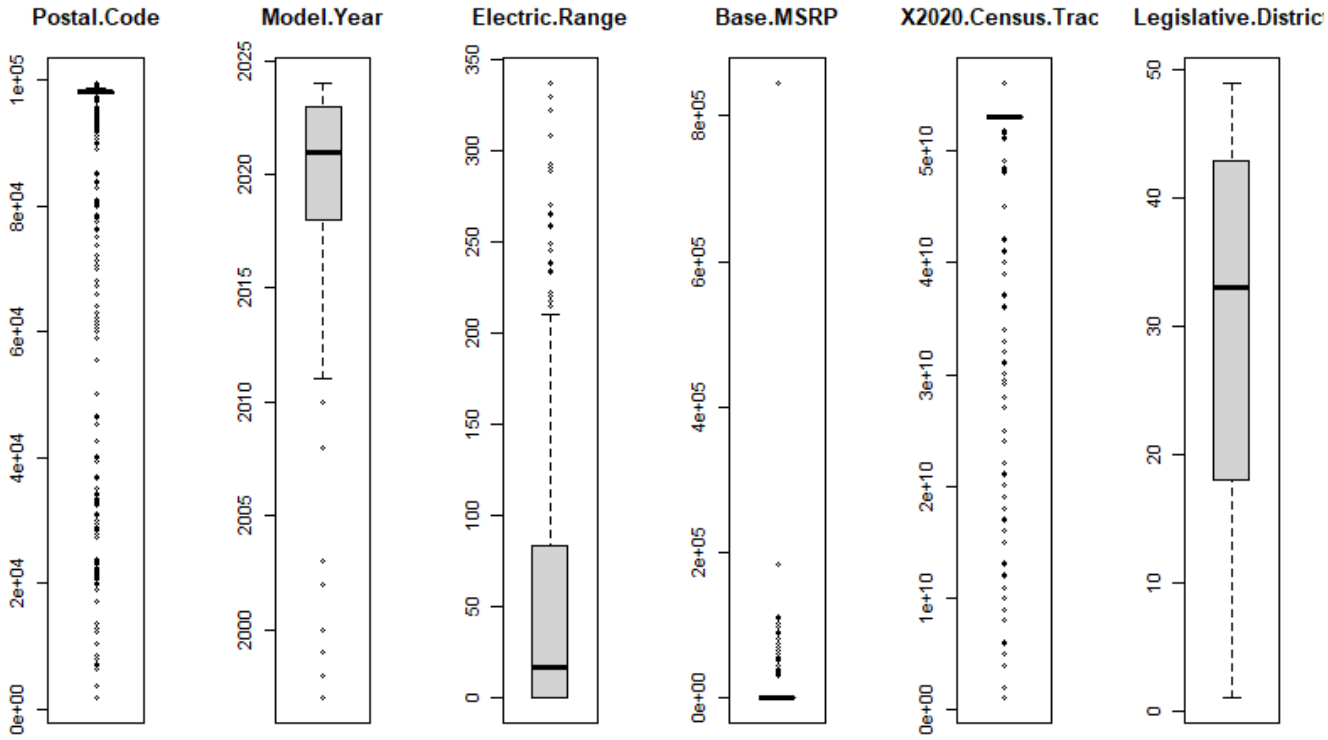
Description: df [339 × 5]

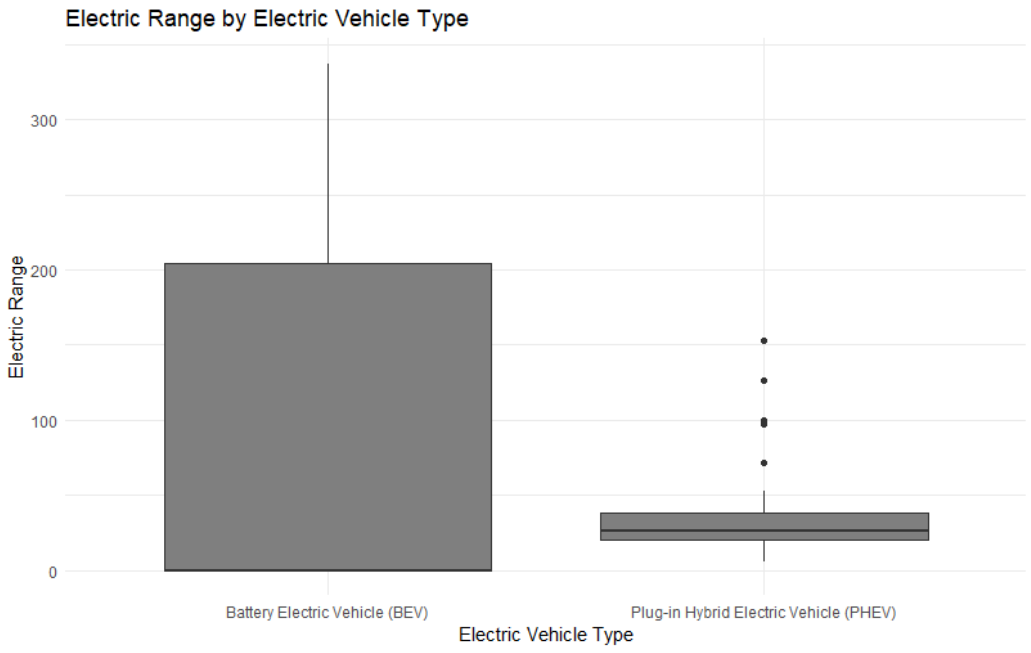
VIN..1.10. <chr>	City <chr>	State <chr>	Legislative.District <int>	Electric.Utility <chr>
5YJSA1E26K	Honolulu	HI	NA	NON WASHINGTON STATE ELECTRIC UTILITY
5YJ3E1EA1K	Minneapolis	MN	NA	NON WASHINGTON STATE ELECTRIC UTILITY
5YJ3E1EA5K	NA	BC	NA	NA
2C4RC1N72J	Omaha	NE	NA	NON WASHINGTON STATE ELECTRIC UTILITY
WBA8E1C32H	Pittsburg	CA	NA	NON WASHINGTON STATE ELECTRIC UTILITY
7SAYGDEE8N	Stafford	VA	NA	NON WASHINGTON STATE ELECTRIC UTILITY
3FA6P0SU9G	Gardena	CA	NA	NON WASHINGTON STATE ELECTRIC UTILITY
WA1VABGE7M	Omaha	NE	NA	NON WASHINGTON STATE ELECTRIC UTILITY
5YJ3E1EB5J	Spring Lake	NC	NA	NON WASHINGTON STATE ELECTRIC UTILITY
5YJXCBE51M	Spring Lake	NC	NA	NON WASHINGTON STATE ELECTRIC UTILITY

1-10 of 339 rows

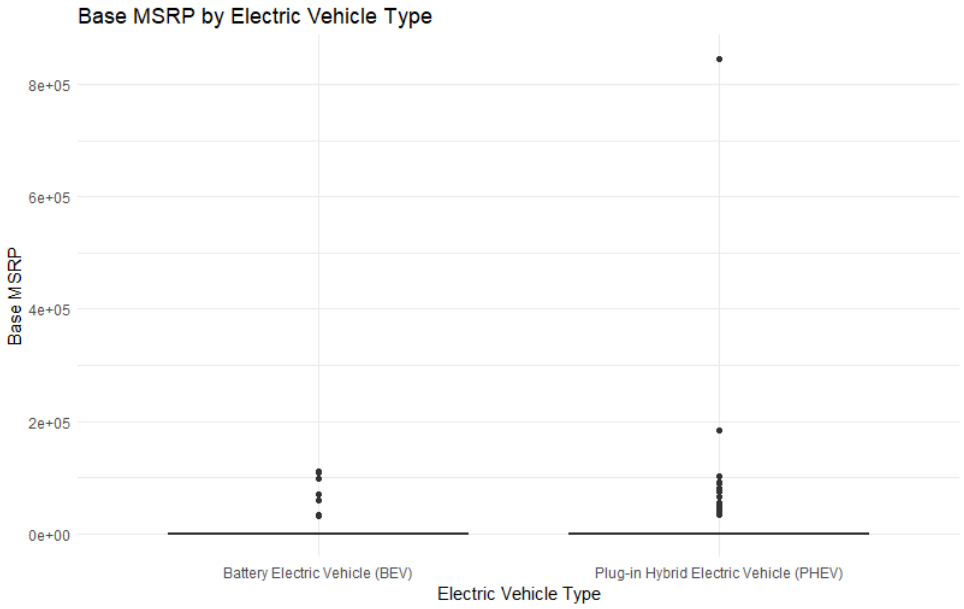
Previous 1 2 3 4 5 6 ... 34 Next

On plotting the boxplot, We see most of the data distribution for Model Year for year 2020 and current. Base Mrsp for most of Vehicles are 0. Most of the electric range for these are 0 to 80.





On Plotting the electric range for PHEV and BEV, we see most of the outlier is for PHEV.



We see most of the base MSRP for the data is zero. This can either mean that there is no base MSRP specified for these vehicles and Dealers have full authority to sell as wanted.

If we categorize by type, one outlier we see is for PHEV.

If we group by Make, Model and Model Year to see if Base MSRP is given for atleast one. We can substitute for rest. For example, if one owner has a 2016 BMW 330E and Base MSRP is given, we can substitute the same MSRP for rest of 2016 BMW 330E owners.

Filter

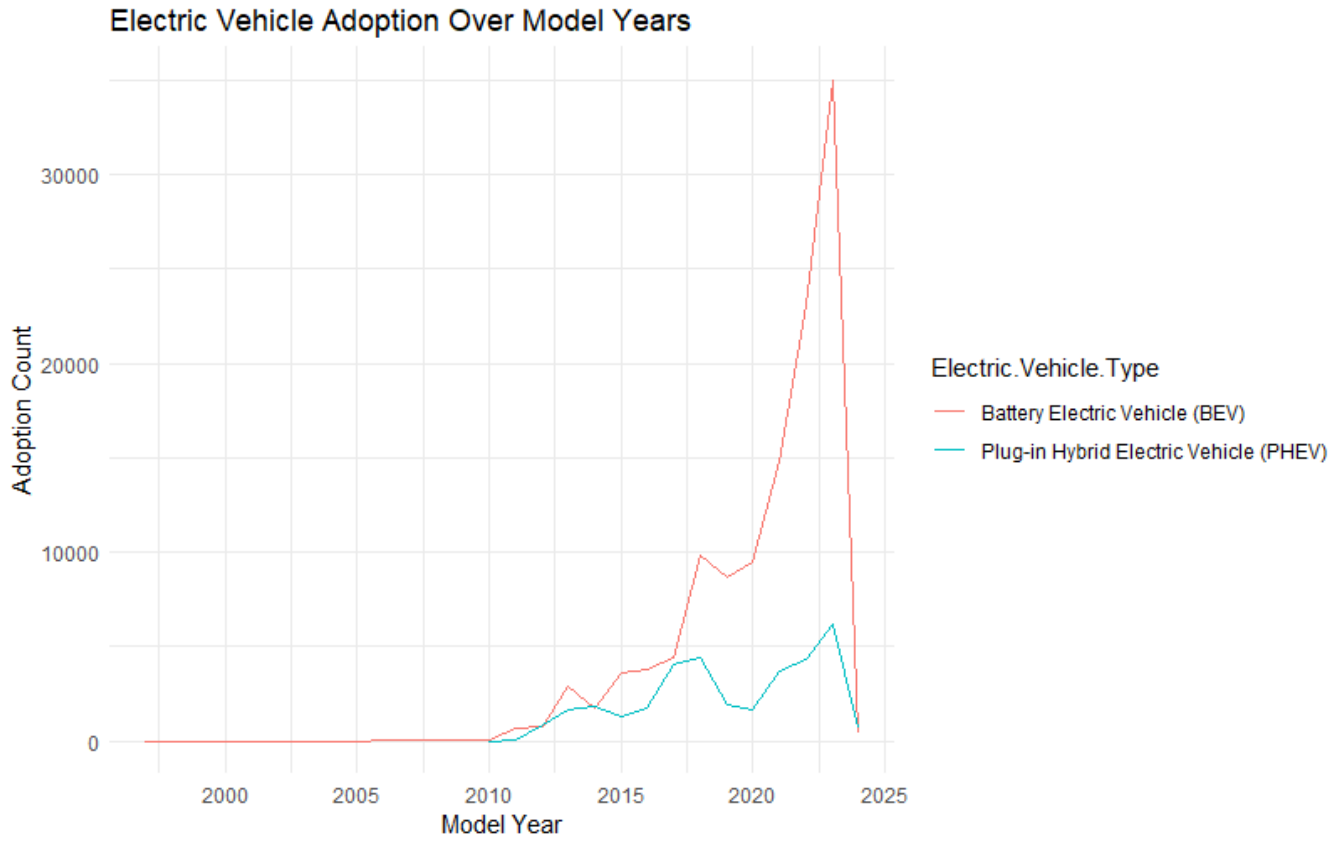
	Make	Model	Model.Year	HasNonZeroBaseMSRP
1	BMW	330E	2016	TRUE
2	BMW	330E	2017	TRUE
3	BMW	330E	2018	TRUE
4	BMW	530E	2018	TRUE
5	BMW	530E	2019	TRUE
6	BMW	740E	2017	TRUE
7	BMW	740E	2018	TRUE
8	BMW	740E	2019	TRUE
9	CADILLAC	CT6	2017	TRUE
10	CADILLAC	CT6	2018	TRUE
11	CHRYSLER	PACIFICA	2019	TRUE
12	FISKER	KARMA	2012	TRUE
13	KIA	SOUL	2016	TRUE
14	KIA	SOUL EV	2017	TRUE
15	KIA	SOUL EV	2018	TRUE
16	MINI	COUNTRYMAN	2018	TRUE
17	MINI	COUNTRYMAN	2019	TRUE
18	PORSCHE	918	2015	TRUE

Showing 1 to 19 of 436 entries, 4 total columns

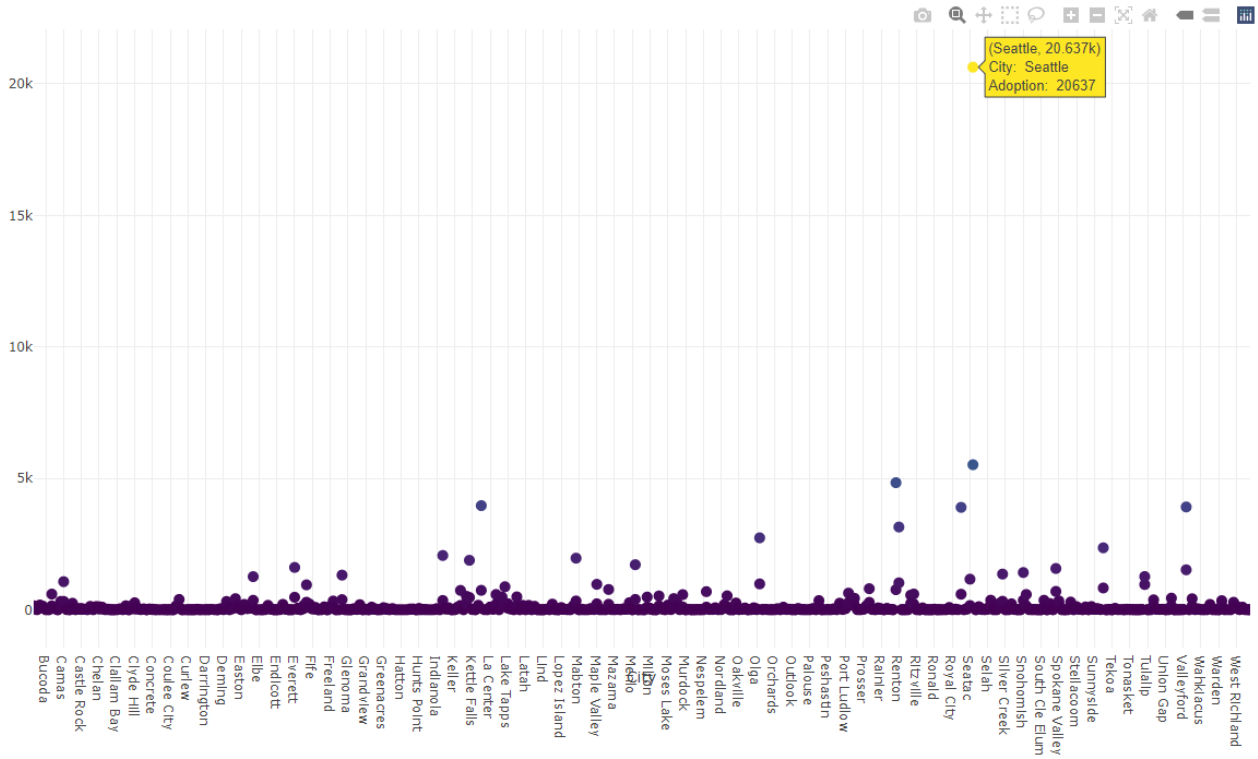
On doing the analysis, we see there are a total of 436 unique Make Model, Model Year and out of which only 30 have MSRP without 0 and rest are 0. We are log transforming the base MSRP for easier evaluation.

Two important visualizations –

1. To show how the adoption of electric vehicles has changed over time. We can plot Model Year and count of electric vehicles. This visualization will help us track the growth or decline of electric vehicle adoption across various model years and understand trends over time.



2. We see the metropolitan city Seattle has the most Electric vehicles adoption in WA.



References:

- Electric Vehicle Population Data (2023) Catalog. Available at: https://catalog.data.gov/dataset/electric-vehicle-population-data (Accessed: 30 October 2023).