

# Leading the Charge: Predicting the Demand for Electric Vehicles and Chargers in Washington State

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Hello, and welcome to our presentation: Leading the Charge: Predicting the Demand for Electric Vehicles and Chargers in Washington State

## The Market at a Glance



Car manufacturers like Volvo, Audi, and Volkswagen planning to go fully electric



Bipartisan Infrastructure deal



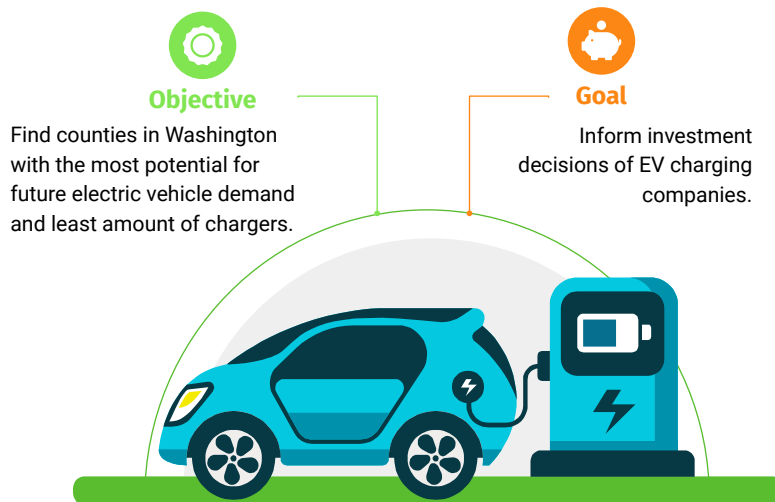
States like Washington and California working on going fully electric in 2030 and 2035



Washington Department of Transportation is planning to spend \$8 million on charging infrastructure projects between 2021 and 2023

As we all know, climate change is one of the biggest threats facing humanity. According to the U.S. Environmental Protection Agency, greenhouse gas (GHG) emissions from transportation account for about 29 percent of total U.S. greenhouse gas emissions, making it the largest contributor of U.S. GHG emissions. Climate change has been getting more and more attention worldwide over the past few years. On the private sector side, some of the largest car manufacturers like Volvo, Audi, and Volkswagen have recently announced that they will be going fully electric in the coming decade. On the public side, President Joe Biden and his administration recently announced that they are working on passing a bipartisan infrastructure deal that would prioritize clean energy and support the development of a nationwide network of electric vehicle chargers. At the state-level, Washington and California are working on abandoning gas vehicles by 2030 and 2035 respectively. Additionally, the Washington Department of Transportation is planning on spending 8 million dollars on charging infrastructure projects in the next two years. There is no doubt that the future of transportation is electric and Washington state is at the forefront of this change.

## Objectives of Analysis



Our objective with this analysis was to find counties in Washington State that have the most potential for future electric vehicle demand, so that an electric vehicle charging company can invest in the right counties and maximize their financial returns.

## Data Sources

01


### Washington State API

433,172 title/registration transactions (2010-2021)

02

### National Renewable Energy Laboratory API

1,686 active charging stations in WA



For this analysis, we looked at the electric vehicle title and registration transactions between 2010 and 2021 provided by Washington State which had a total of 433,172 transactions. Additionally, to understand the current charging infrastructure in each county, we used National Renewable Energy Laboratory data that revealed that there were a total of 1,686 active charging stations in Washington state as of July 2021.

## Defining “Electric Vehicle”

### BEV (Battery Electric Vehicle) - **73% of data**

*All-electric vehicle using one or more batteries to store the electrical energy that powers the motor and is charged by plugging the vehicle in to an electric power source.*

### PHEV (Plug-in Hybrid Electric Vehicle) - **27% of data**

*A vehicle that uses one or more batteries to power an electric motor; uses another fuel, such as gasoline or diesel, to power an internal combustion engine or other propulsion source; and is charged by plugging the vehicle in to an electric power source.*



As you know there are a few different types of electric vehicles. In our analysis we used data for both Battery Electric Vehicles and Plug-in Hybrid Electric Vehicles since these types of vehicles use electric chargers unlike Hybrid Electric Vehicles. 73% of our data was comprised of Battery Electric Vehicles, while the remaining 27% was for Plug-in Hybrid Electric Vehicles.

# Methodology

- Focused on top 10 counties with the greatest number of EV purchases
  - Used a time-series model to forecast the future count of electric vehicles in each county
  - Compared these counts to existing charging infrastructure
- 

So how did we actually use this data? Due to time limitations, we pared down our data to the top 10 counties with the greatest number of new electric vehicle purchases. Then we used a time-series model called SARIMAX to forecast the future electric vehicle counts in each of these 10 counties. Then, as we will see in a few minutes, we looked at the existing charging infrastructure in these counties to pinpoint counties with the greatest number of future electric vehicles and with the fewest existing chargers.



# Results

Here are our results.



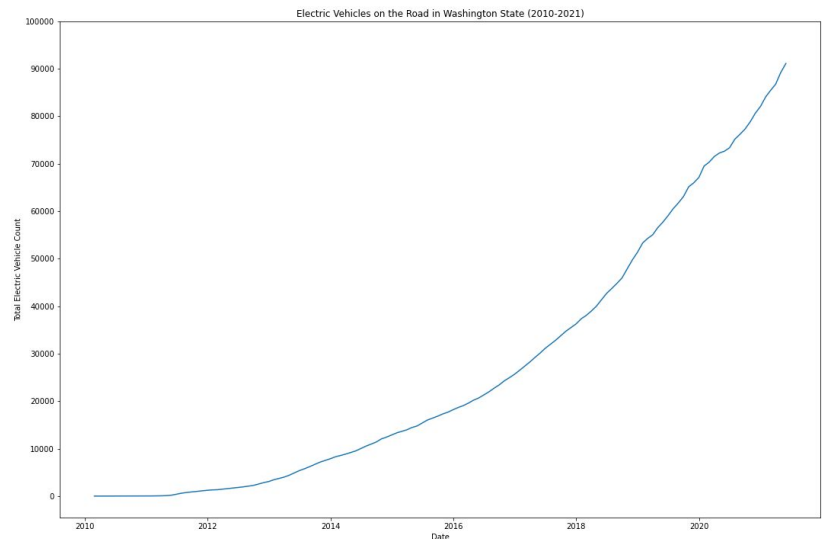
# Growth in Electric Vehicles

To start off, we will be looking at the growth in electric vehicles over the past 11 years in Washington State and its counties.



## EV Count - Washington State

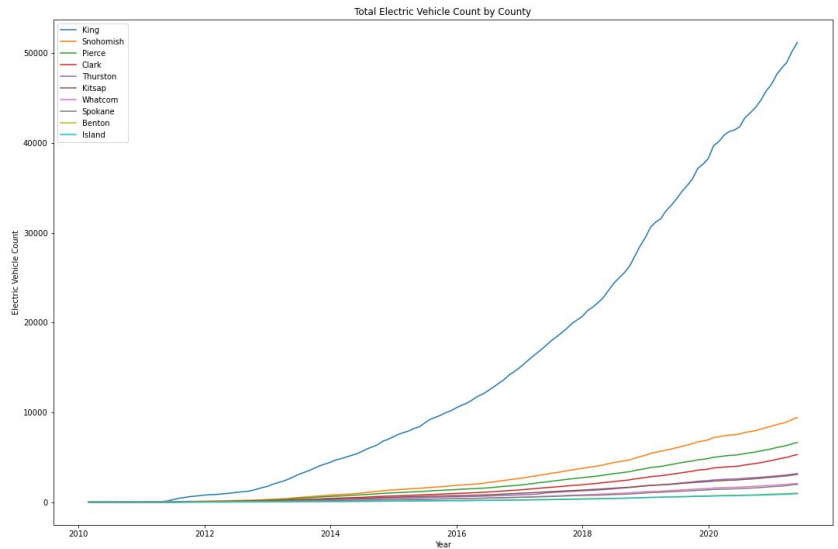
- Exponential growth in EV count
- Demand trend is strong



As we can see above, the number of electric vehicles on Washington State roads have been increasing exponentially over the past 10 years. On a high level, this confirms that Washington State has the necessary demand trend for electric vehicles to make investing in it profitable for an EV charging company.

## EV Counts - Counties with Most EVs

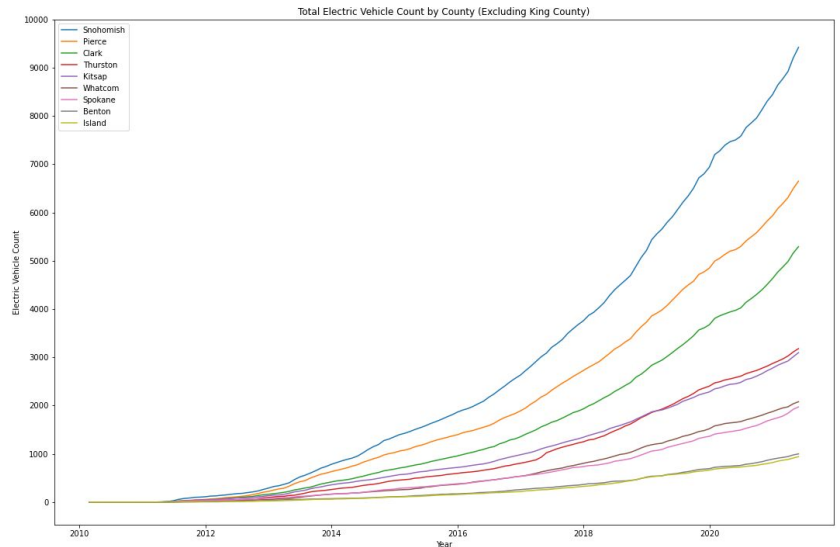
- King County has the most amount of EVs and fastest growth rate
- Seattle has a large impact on this trend



Now that we looked at the statewide trend, we can start looking at individual counties. Here, we can see that out of the top 10 most EV purchasing counties, King County has been growing much faster compared to others. This is expected since King County includes Seattle, which is the largest city by population in Washington State. Due to the scale differences between King County and the other 9 counties, it is difficult to see how these 9 counties compare to each other.

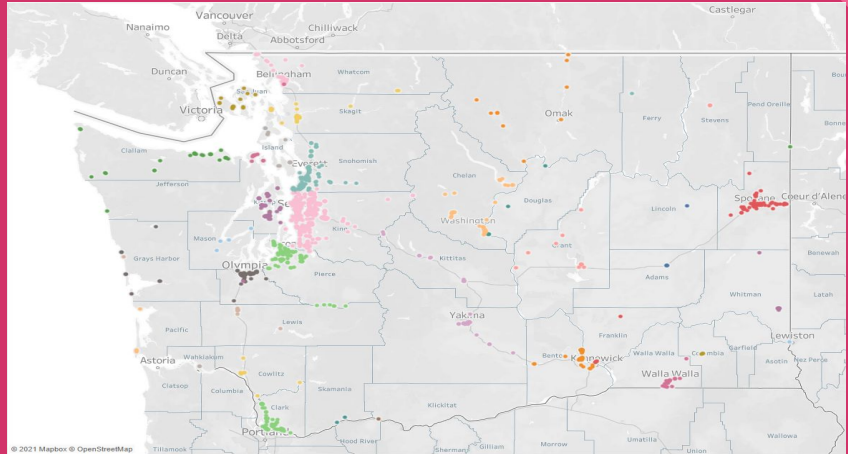
## EV Counts - Counties with Most EVs, Excluding King County

- Snohomish, Pierce and Clark are on top.
- Exponential trend similar to King County.



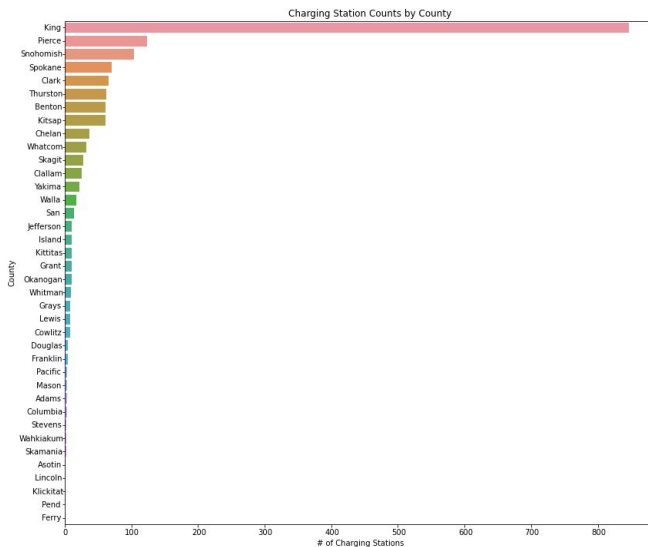
When King County is excluded, we can see that Snohomish County is leading the charge in the number of electric vehicles on the road followed by Pierce and Clark County. The EV counts are also growing in an exponential way similar to King County.

# Existing Infrastructure



In identifying counties worth investing in for electric chargers, looking at the raw electric vehicle counts is not enough and we need to consider the existing charging infrastructure as well.

## Chargers Available in Washington as of July, 2021



- 1,686 active charging stations
- About 50% of charging stations are located in King County (846)
- Pierce (123) and Snohomish (104) counties are second and third

As we can see here, out of 1,686 charging stations in Washington, around 50% of the charging stations are in King County. Pierce County is a distant second with 123 charging stations followed by Snohomish county in third place with 104 charging stations.

How can we compare  
counties and find ones to  
invest in?

EVs per charger ratio =  $\frac{\text{Future electric vehicle count}}{\text{Existing charging stations}}$

So the question is: how can we combine all of these insights to compare counties and find ones that are worth investing in? One way is by taking a look at the future electric vehicles per existing charging stations ratio on a county by county basis. This allows us to compare the counties on a relative basis. The higher this number is, the more underserved the county will be in the future, which translates into more opportunities.

# Dashboard

Electric Vehicle Predictions and Existing Charging Infrastructure in Washington State by [Berke Tezcan](#)



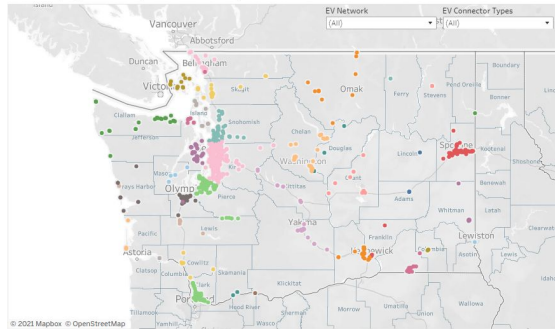
## Projected Number of Electric Vehicles and Current Charging Infrastructure in Washington State

Select County:

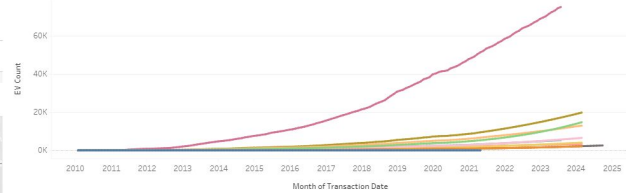
Current Number of Chargers (as of June 2021)

King	Pierce	Snohomish	Spokane	Clark	Thurston	Kitsap	Benton	Chelan	Whatcom	Skagit
846	123	104	70	66	62	61	61	37	32	28

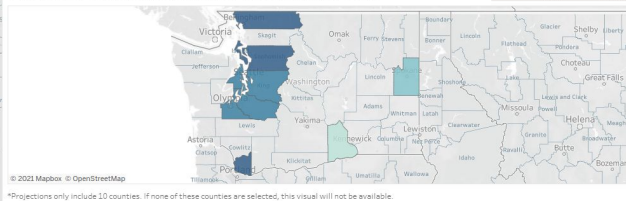
EV Charging Stations (as of June 2021)



EV Count by County



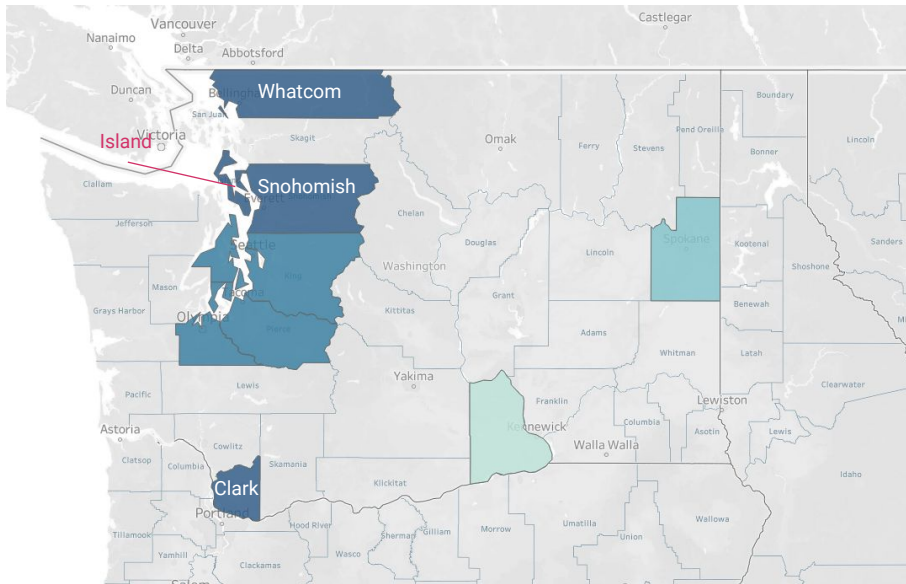
Projected EV Count (August, 2023) per Current Charger Count



<https://public.tableau.com/app/profile/berke.tezcan/viz/ElectricVehiclePredictionsandExistingChargingInfrastructureinWashingtonState/Dashboard1>

We created a dashboard that compiles all of the information we just looked at and shows the EVs per charger ratios for each of the 10 counties we analyzed.

## Counties with Most Potential



So we can say that, relatively speaking, Island, Clark, Snohomish and Whatcom counties will be better counties to invest in. However, these ratios also don't tell the whole story and there are additional factors we should consider. Some of these factors may include things like:

- Proximity to airports
- Proximity to highway entrances
- Proximity to commercial centers/office buildings

Even though Island County is leading the EVs per charger ratio, we don't think that it is a real contender. Firstly, Island County consists of a series of islands and has mostly residential buildings and state parks and very few commercial centers and office buildings. According to Forbes, "80% of EV charging is done at home —almost always overnight— or while a car is parked during the workday". So the electric vehicle owners living in this county will most likely be charging their vehicles at their own homes instead of using commercial charging stations. Additionally, due to the limitations of the land, the population in this county may stagnate in the future which may translate into the demand in EVs and therefore chargers stagnating as well. So Clark, Snohomish and Whatcom counties may be more attractive options based on these factors.



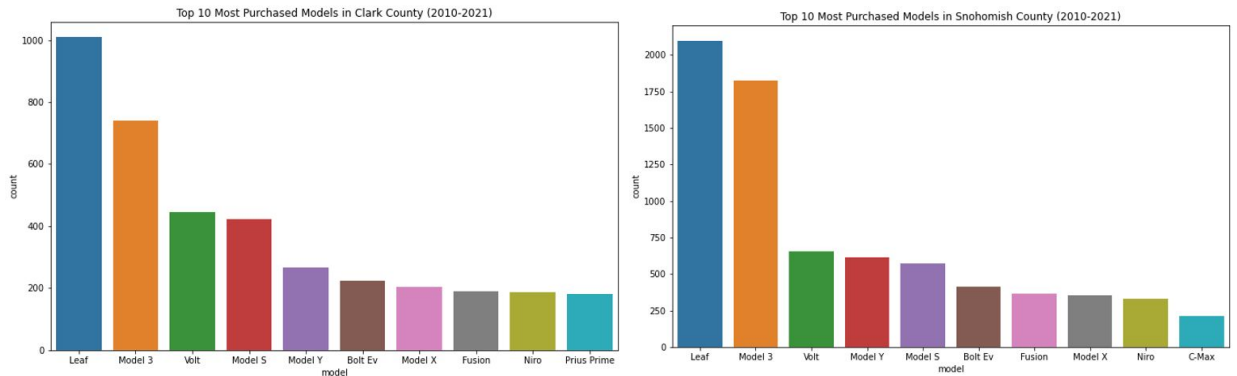
# Most Purchased Models

- What kind of charging station to build (level 1, level 2, level 3)
- Spacing of chargers based on the size of vehicles
- Whether to include adapters for different connector types (Tesla, CCS, CHAdeMO etc.)

Now that we know which counties have the most potential for the highest demands, we can provide a few insights on what's out on the road in these counties. This can help when deciding things like:

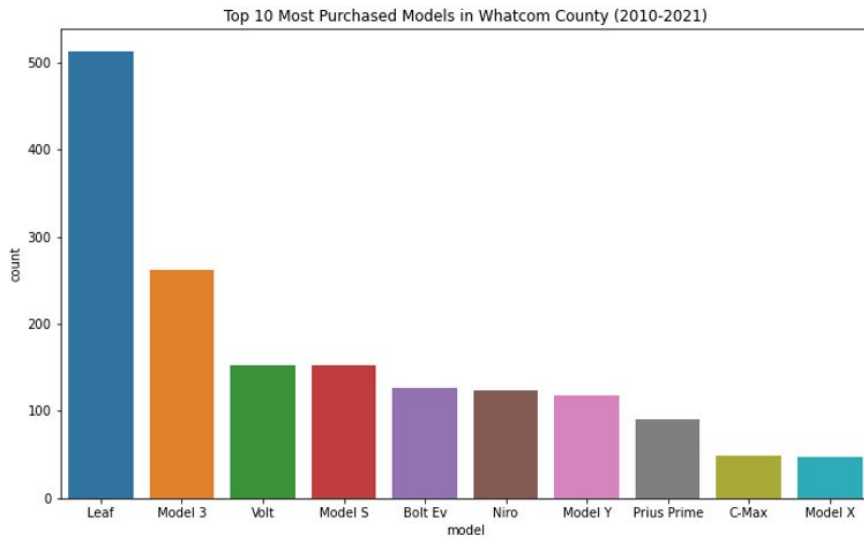
- What kind of charging station to build (level 1, level 2, level 3)
- Spacing of chargers based on the size of most common vehicles
- Whether to include adapters for different connector types (Tesla, CCS, CHAdeMO etc.)

## Top 10 Most Purchased Models - Clark & Snohomish Counties



In both Clark and Snohomish counties, Nissan Leaf and Model 3 are by far the most purchased electric vehicles followed by Chevrolet Volt.

## Top 10 Most Purchased Models - Whatcom County

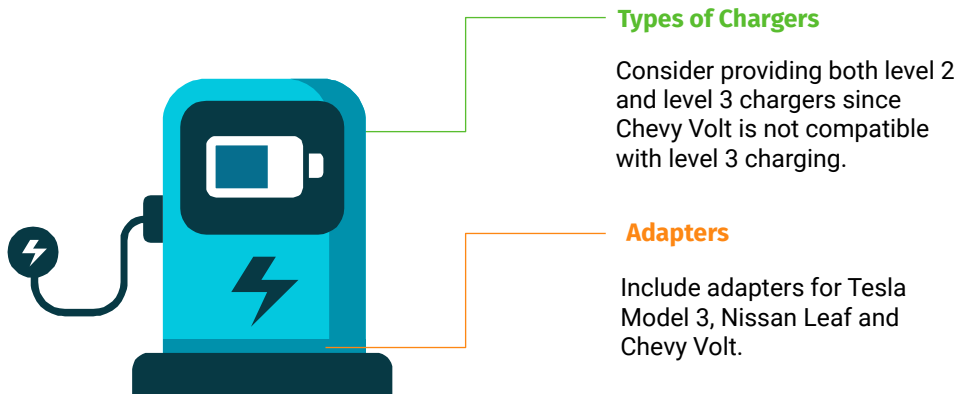


Similarly, Whatcom County's most preferred vehicles are the Nissan Leaf, Tesla Model 3 and Chevrolet Volt as well.

# Conclusions & Recommendations

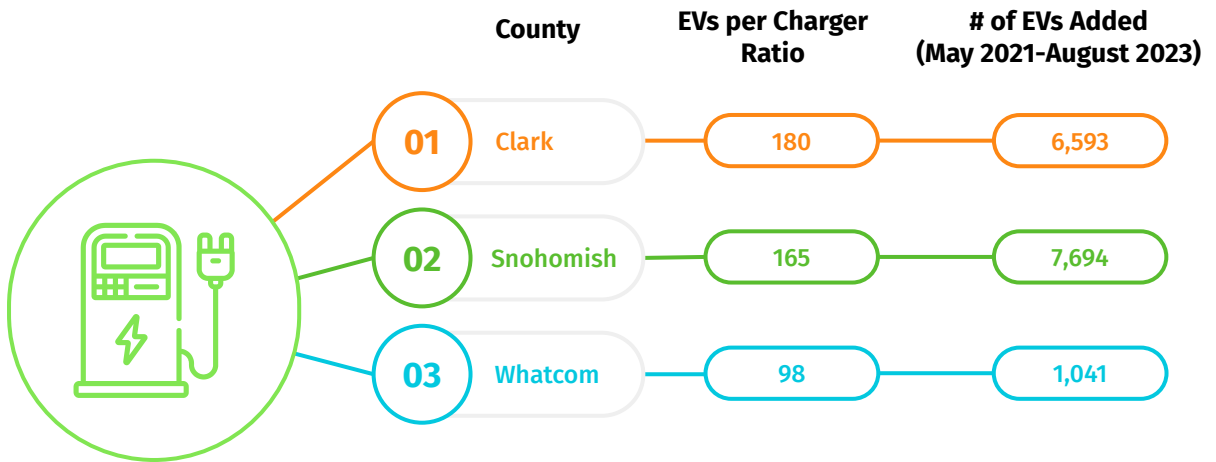
So here are our conclusions and recommendations.

## Charger Configuration



Based on the most preferred models in each county, we recommend including adapters for Tesla, Nissan Leaf and Chevy Volt in the new charging stations at the very least. We also recommend providing both level 2 and level 3 charging at each station to be able to provide power to vehicles that are not able to accept level 3 charging such as the Chevy Volt (which was the third most popular vehicle in these counties).

## Best Counties to Invest In



We think that the best counties to invest in, in rank order, are Clark, Snohomish and Whatcom counties. Considering the projected demand for electric vehicles, plus these counties' proximity to major cities, highways, airports and commercial and office buildings, we believe that these three counties' existing charging infrastructure will be insufficient in the next several years. Combined with the possibility of government funding, these counties offer great potential for financial success for electric vehicle charging companies.



# Thank you

For more information [github.com/ebtezcan](https://github.com/ebtezcan) or [berketetzcan@gmail.com](mailto:berketetzcan@gmail.com)

This is an opportune time for electric vehicle charging companies in Washington and we look forward to seeing more charging station availability in the coming years. Thank you, and please feel free to contact me if you have any questions.

## References

Infographics template by [Slidesgo](#) and [Freepik](#).

[https://energytransition.org/wp-content/uploads/2017/11/Charging\\_station\\_MIA\\_09\\_2017\\_5954.jpg](https://energytransition.org/wp-content/uploads/2017/11/Charging_station_MIA_09_2017_5954.jpg)

<https://www.forbes.com/wheels/news/jd-power-study-electric-vehicle-owners-prefer-dedicated-home-charging-stations/>



## Appendix - Comparison of Counties

	EV Count for 2021-05-31	EV Prediction for 2023-08-31	Existing Charger Count	Chargers per EV	EVs per Charger	EVs Added (Today-2023)
County						
Island	943.000000	1855.000000	10.000000	0.005000	186.000000	912.000000
Clark	5294.000000	11887.000000	66.000000	0.006000	180.000000	6593.000000
Snohomish	9423.000000	17117.000000	104.000000	0.006000	165.000000	7694.000000
Whatcom	2081.000000	3122.000000	32.000000	0.010000	98.000000	1041.000000
Pierce	6652.000000	11407.000000	123.000000	0.011000	93.000000	4755.000000
Kitsap	3097.000000	5653.000000	61.000000	0.011000	93.000000	2556.000000
King	51209.000000	74875.000000	846.000000	0.011000	89.000000	23666.000000
Thurston	3181.000000	5299.000000	62.000000	0.012000	85.000000	2118.000000
Spokane	1973.000000	3507.000000	70.000000	0.020000	50.000000	1534.000000
Benton	1000.000000	1820.000000	61.000000	0.034000	30.000000	820.000000