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February 26, 2022

Electric vs Gasoline Automobiles

Section 1: Research Question

I've always wanted an electric car. I grew up in an environmentally conscious area, and as a child we learned about alternative energy methods for automobiles. At the time, electric cars were an expensive, luxury item. They weren't particularly reliable in terms of use, and they generally had to be replaced long before the owner could reap any fiscal benefits. Essentially, it was an unobtainable fantasy for someone coming from a lower-middle class family.

Since then, over the past 20 years, huge advancements have been made with electric cars. Only five years ago, we would probably still consider an electric car a luxury item – typically in the form of a Tesla. As we enter the year 2022, more and more mainstream automobile companies are producing electric vehicles. Even the first electric truck has entered the market (the Rivian R1T); we can expect the Ford F-150 Lightning sometime this year, and the Chevy Silverado EV by the summer of 2024.

As someone who has always wanted to own an electric vehicle, I think now is the best time to reassess electric vehicles. My research question is: Are there significant benefits (fiscally and environmentally) that should encourage motorists to switch from gasoline to electric automobiles?

Section 2: Motivation

My husband and I have two vehicles. The first (mine) is a small SUV (Ford Escape) and the second (his) is a mid-sized truck (Chevy Colorado). When he finally moved up from Texas to join me in Maryland, we ended up swapping vehicles due to our respective commutes. My commute is 28 miles (~30 minutes) and my husband's commute is 64 miles (~90-120 minutes). It was a few weeks after he moved up that he asked to drive my vehicle to try and save money on gas – he was refilling the tank every couple of days. Having swapped, we both fill up roughly once a week.

After a few more months driving my vehicle, my husband approached me about selling my car and replacing it with an electric car. I was extremely resistant at first. I was concerned that in the stop-and-go traffic that my husband frequently encounters on his commute that the battery would die, and he would end up stuck on the highway somewhere between home and work. I eventually came around to the idea after he did some research and we're now considering a purchase.

Section 3: Data

I will begin the project using two different datasets. The first is the example "mtcars" dataset that is included with R. This dataset is frequently used by beginners who are learning the capabilities of the software they're using. I picked this dataset to

set a baseline for my gasoline automobiles information. I will need to add to it so that it encompasses the information I need – the main piece that is missing that I need for my purposes is the projected range of a vehicle on one tank of gas. Additionally, the vehicles in this dataset are more on the sportscar variant of automobiles. If I want to make a fair comparison, I will have to find and add data for more conventional vehicles that the average person would drive.

The second is a dataset has the data concerning electric cars: Electric Cars 2021. I found this dataset on Kaggle.com. It was created by the user Yo Han Joo, and it was last updated approximately 4 months ago. There is some risk using data from an unvetted source, but the intent of Kaggle is that data scientists collaborate and that we try to do our best by each other. This dataset includes the data for 185 electric cars, which is much more extensive than the mtcars dataset. Most importantly, it includes information on how far a vehicle can go on a single charge.

I will have to be careful with how I compare the statistics from these two datasets. The nature of electric and gas automobiles makes them inherently incompatible. The most common measure for gas car efficiency is “miles per gallon”, which is included in the mtcars dataset – however, there is no comparable metric for electric cars. Even if I were to calculate something like “miles per kilowatt”, it still wouldn’t be an effective metric for comparison. Therefore, I will have to look up tank volume for the given gas vehicles and add a variable that states the range on one tank of gas.

NOTE: I did attempt to find an opensource dataset with gas automobiles like the dataset on electric cars so that I could avoid having to research vehicles myself. Unfortunately, all the datasets I found were either old or were focused on used vehicles.

Section 4: Study Objectives

The primary objective I will seek to answer is if there are significant fiscal benefits to owning an electric car verses a gasoline care. I will do this by initially comparing the ranges of comparable vehicles (van, sedan, truck, compact). I will use the average projected daily, weekly, and monthly mileage for my commute (relatively short) and my husband’s commute (relatively long) and assess what the top performing vehicles for each category achieve. I will also look at the cost of gas and the cost of electricity for where I live in addition to at least two other locations – I’m initially thinking Texas and Vermont. The desired end state is to be able to say with confidence which vehicles incur the smallest commute expenditure. In other words, if you spend less money driving a gas car or an electric car.

If I have the opportunity to research a second objective, I will want to look at the environmental impact that driving each car has. I will do this by trying to calculate the pollution rate of a single vehicle over the course of a year (using the commuter information of myself and my husband). Then I will look at the average pollution statistics for commuter vehicles and see what the difference would be if 10%, 25% and 50% of current gas vehicle commuters switched to electric cars. I expect that the annual pollution rate would go down regardless, but the question is: Is the amount pollution (greenhouse gas emissions) goes down significant enough to warrant advocating for it?