Electric Vehicles (EV) – Are We There Yet?

Shekhar Nagendra, Economist - shekhar.nagendra@vec.virginia.gov

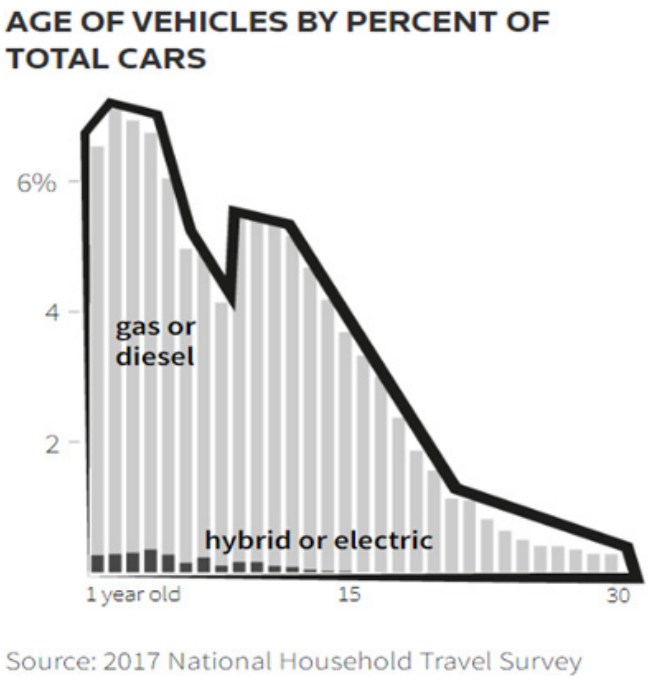
Judging from popular news headlines and blogs forecasting EV sales, it appears as if EVs will replace gasoline cars very soon. For example, the following picture in a 2018 article (https://www.icis.com/asian-chemical-connections/2018/12/internal-combustion-engines-car-ownership-to-quickly-head-the-way-of-horses-and-carts/) compares the rapid replacement of gasoline cars by electric vehicles, to the replacement of horse carriages by automobiles in the early 1900s, and is popular among writers predicting the quick demise of gasoline cars within 13 years (by Easter 2035):

5th Ave. New York City, Easter 1900, Spot the car

5th Ave. New York City, Easter 1913, Spot the horse and buggy

However, the data tells a slightly different story. Currently, 99% of the 250 million cars, SUVs and light-duty trucks on the road in the United States run on gasoline/diesel, and less than 1% are EV (EVs include Battery Powered Electric vehicles (BEV), and Plugin Hybrid Electric Vehicles (PHEV)). Only about 17 million new cars are sold each year. Additionally, modern gasoline/diesel cars last a long time - about 16 years on average. Therefore, transitioning the current 250 million strong U.S. auto base is likely to be a slow process (see Figure 1).

Figure 1



Source: 2017 National Household Travel Survey

EVs are much more expensive compared to gasoline vehicles. The average price of an EV is 33% higher than a gas powered vehicle, and the average starting price for the top 10 best-selling EVs in America is $60,500. Even at the low end of the price spectrum, taking the Hyundai Kona and the Ford F-150 as examples, the contrast is evident:

Hyundai Kona: $22,595; Hyundai Kona Electric: $35,295
Ford F-150: $40,960; Ford F-150 Lightning : $54,769
(Source: Car and Driver)

Government tax credits help, but only partly. The current EV tax credit is a federal incentive built to encourage drivers to purchase an EV. This incentive is not a check – it is a tax credit worth up to $7,500 that one is eligible for if a new (not used) EV is purchased (not leased).

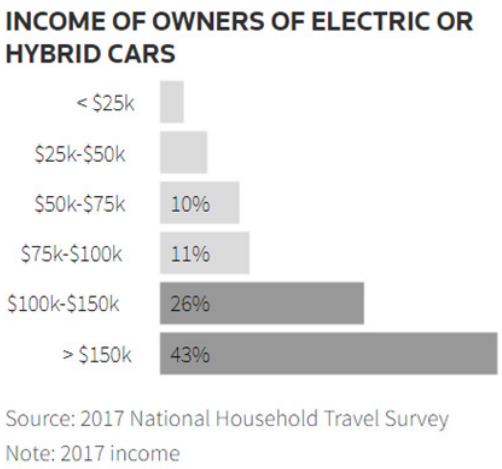
Additionally, when a particular manufacturer reaches 200,000 EVs sold in the United States, those vehicles are no longer eligible for credits. Currently, Tesla and GM have run out of these credits, and Nissan will be next. As more EVs become available, and are sold, other makes will also lose the ability to offer the credits.

The Inflation Reduction Act (IRA), signed into law on August 16, 2022 by President Biden, takes effect on January 1, 2023 and one of its objectives addresses these shortcomings. The new law allows

consumers to get up to $7,500 for a new EV no matter how many cars have been sold by the manufacturer. Eligible used vehicles will also qualify for a credit of up to $4,000. These new credits will be no longer delayed tax credits – instead they will be applied immediately at the point of sale to lower the eligible vehicle's price by up to $7500. However, the IRA stipulates new rules and restrictions (for example, the final assembly must be in the USA – this makes the Tesla and most models ineligible), and buyers need to fully understand the new rules to ensure the model they buy is eligible for the credit.

Over two thirds of EVs are purchased by affluent consumers. Purchase incentives, like tax credits or rebates, only appear to be availed of by consumers already able to afford the high cost of a new EV. About 70% of households who own EVs earn more than $100,000 per year (see Figure 2).

Figure 2



Source: 2017 National Household Travel Survey
Note: 2017 income

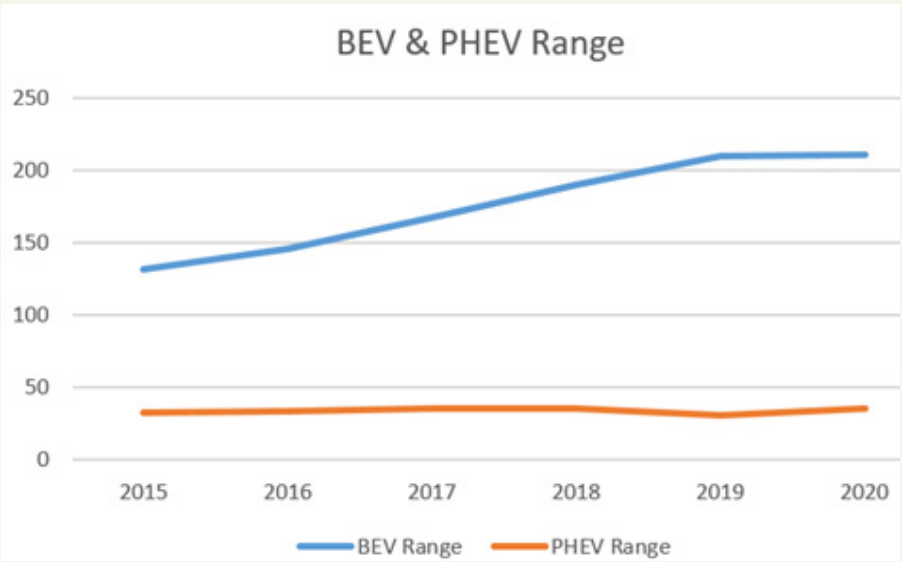
The time it takes to recharge and the availability of recharge stations is a big concern. Consumers are accustomed to refueling their gasoline/diesel vehicles in 5-7 minutes. By contrast, Level 1 and Level 2 (slow/medium) chargers take anywhere from 6 to 16 hours, and level 3 (fast chargers) take 30 minutes.

There are currently about 104,000 public charging plugs available in the U.S, mainly in dense urban areas in the East and West coasts. Hundreds of thousands more are needed especially in underserved and rural areas. There are about 18.5 EVs per charge station currently, but international benchmarks suggest that at least one charger is needed for every 10-15 EVs, in addition to home charging.

Range Anxiety also remains a concern. PHEVs remain the more popular option compared to BEVs, as consumers are reluctant to switch to all-electric technology, and prefer to have the (small) gasoline tank as a backup to the battery. Battery performance has improved but plateaued since 2018, and continued improvements are needed to help alleviate consumers' "Range Anxiety" for BEVs (see Figure 3).

Figure 3

(Source: IEA; Kilometers have been converted to Miles)

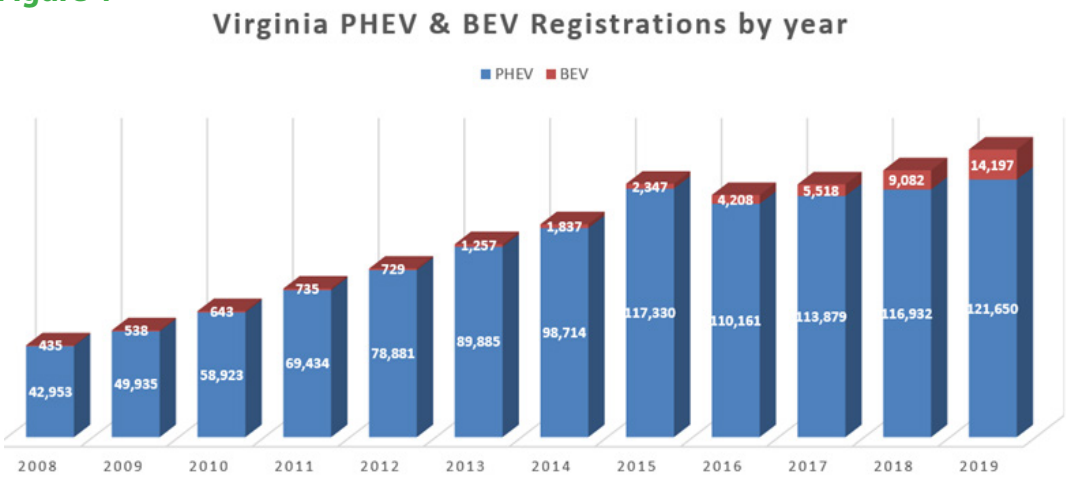


Federal and State programs are coming up with new incentives and mandates to support and increase EV adoption. President Biden has set an ambitious goal for half of new car sales to be electric, fuel cell, or hybrid Electric vehicles by 2030. The IRA bill mentioned earlier supports this goal. In addition, the Infrastructure bill that passed Congress in November 2021 includes a $7.5 billion investment to install 500,000 new charging stations across the U.S. This investment could be the turning point in the deployment of electric vehicles in the U.S. Getting drivers to switch from gas-powered to EVs is essential for the U.S. to be carbon-neutral by 2050.

So far, 14 states and Washington, D.C., have adopted California's regulations that require 100% of all new cars and light trucks sold to be zero emission by 2035. Virginia is one of these 14 states. In Virginia, sales of PHEV and BEV have grown considerably year-over-year (Figure 4).

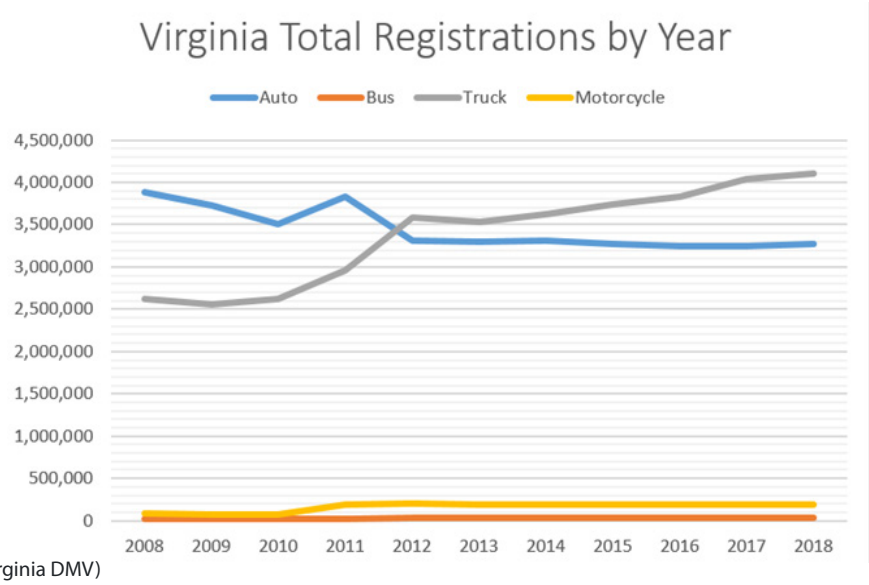
EV sales have grown rapidly, even as overall sales of cars and trucks in Virginia have remained flat (Figure 5).

Figure 4



(Source: Virginia DMV)

Figure 5



(Source: Virginia DMV)

The above graphs for Virginia are representative of overall trends worldwide, and demonstrate the fact that a greater percentage of new vehicle sales each year is being driven by EVs.

Some automakers are committing to an all-electric future. In 2021, several major automakers have announced plans to accelerate the transition to a fully electric future by developing new product lines as well as converting existing manufacturing capacity. Key examples include:

- Lexus aims to achieve 100% BEV sales globally in 2035
- Mercedes announced that from 2025, all newly launched vehicles will be fully electric
- Ford expects one-third of its sales to be fully electric by 2026 and 50% by 2030, building on the success of its F-150 electric model, and to move to all-electric in Europe by 2030
- General Motors pledged to go all electric by 2035

In summary: These announcements from the auto manufacturers are encouraging, but we are not there yet. Until electric cars become more affordable, offer greater range, faster charging, and more model choices, the data suggests the going will be slow. With strong government and industry support, and continued technological advances, a fully all-electric automobile future is possible by 2050. However, it might be overly optimistic to expect it by Easter 2035.