Electric Vehicles Electric Nightmares

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I. Introduction

As a car enthusiast, this project began as a labor of love. Since childhood, I have loved cars, all shapes, all sizes, I love them big and little, I love them loud, I love them fast. I love them all…but I love them with GASOLINE. Then they invented Teslas and the torque in a Tesla…oh wow. A Tesla Plaid can go from 0-60 in 2.1 seconds. That means that this much cheaper, electric newcomer is faster than a Bugatti Chiron with a 4-million-dollar price tag. Oddly enough, shortly after learning this, I had the opportunity to write a research paper and the first topic suggested was on electric cars. The endeavor piqued my interest and my craving for knowledge. What better topic than learning about EV’s? They are, after all, poised for world takeover. I called this research paper, Electric Vehicles, Electric Dreams. I began my exploration into the world of electric cars with rose colored glass, but my dream soon faded. My new love for electric cars disappeared shortly after I began my digging for information; the more I learned about the lack of infrastructures, and the environmental and social damage their components cause, the more I realized that EV’s aren’t that good for our world at this time. I changed the title of my project to Electric Vehicles Electric Nightmares and resigned myself to my own fate of learning why we are not ready for the electric vehicle takeover unless many changes are made.

II. History of Electric Vehicles

Vehicle manufacturers have been long been making attempts at large volume production of electric vehicles, but after years of failed attempts those dreams have finally become a reality. Since the advent of the 2004 Tesla Roadster and the Mitsubishi i-MiEV in Japan in 2009, electric cars are here to stay and manufacturers are working hard to keep up with the demand from consumers around the world. In the last few years, electric vehicle production has increased so much that momentum is increasing for the adoption of no-gas vehicle policies in many countries and states, some implementations as early as 2030. While it is very exciting for consumers, manufacturing and environmentalist, the shift from gasoline powered vehicles to electric is facing many challenges, most of which will require dramatic adjustments in order to make a worldwide movement to 100% electric vehicles a reality.

III. How Electric Vehicles Work

The difference in traditional internal combustion engines and electric battery vehicles is very pronounced. ICE vehicles are powered by gasoline, which feeds into a very complex engine and requires a transmission to provide power to the wheels. An electric vehicle is powered by plugging into the electrical grid, which feeds a large bank of batteries. These batteries then generate power for a DC motor that is much smaller, yet more powerful than a traditional internal combustion motor. EV’s do not require a transmission to drive the wheels. Electric vehicles are lighter and have more torque than internal combustion vehicles.
IV. Electric Vehicle Statistics

Momentum is increasing around the world for the adoption of electric vehicles and the supporting statistics are impressive. Many countries have implemented policies to end the production of internal combustion vehicles completely. These are very ambitious plans considering that in 2020 EV sales only accounted for a mere 4% of new vehicles sold globally. This is still a major leap from 2019 with an increase in sales over that year of 67%. Considering that the first EV was made accessible to the public in 2008, production and infrastructure has come a long way. Many companies such as Amazon, IKEA and DHL as well as ride-share companies such as Uber and Lyft have set target to electrify their vehicles by 2030. Since 2015, the global share of electric vehicles has increased exponentially at an average of 50% per year. If this continues, EV’s will account for 50% of all light-duty vehicle sales worldwide by 2026. An example of the top-speed possibilities is the EV growth in Norway. In 2011, EV’s in Norway accounted for 1% of the market share; by 2020 they made up 54%. According to the Norwegian Road Federation, in 2022, 79.3% of new cars in Norway were battery electric vehicles (BEVs). The global electric vehicle market for 2021 was about $170 billion USD and is expected to reach more than $1103 billion USD by 2030. China has hundreds of EV companies with over 300 models to choose from. In Europe there are about 184 models and in the United States there are 65 (and growing). In the last year, the increase in models available has increased globally by about 22%. Automakers and consumers prefer SUV’s; about half of electric car models available worldwide are SUV’s. Driving range has seen very little improvement in the last ten years. This comes with a compromise of a higher price because of increased weight and larger batteries. One of the newest companies is Changan, which offers a model very similar to a Tesla, retailing at $26,000. The top selling electric vehicles in the US between 2012 and 2021 are the Nissan Leaf, Chevy Volt, Tesla Model S, Tesla Model 3 and Tesla Model Y. While all this data is notable, most of it is overly ambitious and there are many barriers to prevent EV’s from reaching these goals any time soon.

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V. **ICE Bans and Tax Incentives**

Many countries and states have set goals to phase out gasoline powered vehicles by years in the not-too-distant future. Many of these “ICE Bans” (Internal Combustion Vehicle) have lofty goals with pledges to reach zero emissions from motor vehicles within fifteen years. India, the world’s second most populous and number one country for poorest air quality according to the World Health Organization, plans to phase out internal combustion engines by the year 2030. How is that going to be possible when they have seven years to reach this goal and over 50 million people in India have no power in their homes?

The United States offers a tax credit to each family that purchases and electric vehicle up to $7500. This incentive is a part of the Inflation Reduction Act of 2022 that was signed into law by President Biden in August. This bill is partly designed to reduce deficit and inflation by combating climate change. The EV tax credit is a notable part of the law’s focus on clean energy. Unfortunately, there are stipulations which many consumers do not realize until after they buy their new car. First, the credit only available for vehicles that complete their final assembly in North America. This eliminates the majority of affordable electric vehicles as most of them are produced in other countries. The second string attached to the Inflation Reduction Acts regarding tax credits is that the credit begins to phase out for a manufacturer’s vehicles when at least 200,000 qualifying vehicles manufactured by that manufacturer have been sold for use in the United States (determined on a cumulative basis for sales after December 31, 2009). Two current examples of this is for the 2023 Cadillac Lyriq (which sold out in an incredible four hours) and The Chevrolet Bolt EV. As of October 2022, the 200,000-manufacturing cap on these vehicles has already been exceeded and no more vehicles are eligible for the tax credit.
VI. Charging and Infrastructure

The biggest hurdles to overcome before electric vehicles can be sold to everyone is charging infrastructure and charging capabilities. At this time, electric vehicles only make sense if you can charge your car at home and only commute to and from work. They are not for travelers as highway charging systems are insufficient or non-existent in some places. Here is a basic example of the problem. Let’s say a family is taking a road trip from Birmingham, Alabama to Dallas, Texas. They have a brand new 2022 Chevy Bolt with a range of 259 miles and a Level 3 Super-Fast charging time of 160 miles in about an hour. Their Level 2 Fast charging time is 25 miles in one hour of charging. Before they leave they look on the department of Energy’s website to see where the alternative fuel stations are along the 1-20 corridor they will be traveling. They realize that there are no stations listed on the map for this 636+ mile drive. This means they will have to research where to stop at least three times along their journey. Perhaps they choose to stop at a Whole Foods or Walmart, but these stops are 10 miles out of the way, and they may have to wait to charge their vehicle if no stations are available. This can cause a delay of several hours, even a half a day with just one stop. This is the perfect example demonstrating the impracticality of electric vehicles for the family that doesn’t have a point A to point B type of lifestyle. Until the infrastructure is reliable and much larger it just isn’t feasible to have an electric car with the stress and worry it will bring.
VII. Lithium Supply and Demand

Electric vehicles mainly use lithium-ion batteries for fuel. Most plug-in hybrid and all-electric vehicles use lithium batteries because of their high energy per unit mass than of battery storage systems. They also have high power-to-weight ratio, are very energy efficient perform well in high temperature, have a slow rate of discharge and most components can be recycled. With many states issuing mandates to phase out gasoline powered vehicles there are many dilemmas we face with the fuel that keeps electric vehicles on the road. Many people question whether it is ethical to purchase an EV that is lithium based because of human rights violations in the mines where both the lithium and the cobalt in the batteries is produced. Another question is whether the use of lithium is sustainable. Do we have enough of this valuable resource to meet the demand called for in the coming decades? According to the International Energy Agency (IEA), the world could be facing lithium shortages as soon as 2025 because of global demand. We also face rising prices of lithium. The price for lithium has skyrocketed in the last two years. According to Fortune, the prices for lithium have increase 438% just this year. The industry predicted this rise long ago due to an increase in the demand for batteries and a very limited supply of the metal. Part of the supply problem is that lithium is concentrated in very few places on earth and China owns 70-80% of the supply chain. Five major companies are responsible for three-quarters lithium production around the globe.

The world’s lithium reserves are not large enough to meet the demand that will required in 2025. Campaign Group’s transport and environment studies show that there is only enough lithium mined to produce 14 million EV’s in 2023. That will leave many buyers empty handed.
In 2022 Volkswagen already sold out of EV’s in the USA and Europe and Ford’s E-Transit van sold out before they even began production. As of mid-July, the price of Lithium has skyrocketed more than 600 percent since January, from about $10,000 per metric ton to $62,000 according to Benchmark Market Intelligence. Citigroup says that more “extreme” price hikes will follow. The soaring prices are due to the increasing demand for light-duty EVs, sales of which doubled to 6.3 million units last year. They are projected to hit 26.7 million units by 2030, according to Platts Analytics. After years of falling prices, EVs are becoming more expensive, reversing a trend that had the environmentally friendly vehicles on track to soon be cost competitive against gasoline-powered cars. Tesla has raised its prices by more than 20 percent since last year, putting its vehicles out of reach of millions of potential buyers. If these rising prices continue, how will it be possible to phase out gasoline powered vehicles if most of the population cannot afford the alternative.
VIII. Lithium Mining

Is it right to rape the earth the way that lithium mines do? Vast areas of landscape are destroyed and entire mountains are torn down just to mine the white gold the earth contains. Lithium extraction requires huge volumes of water, often 50,000 liters per day\textsuperscript{26} and often the lithium deposits are found in drought prone areas such as South America, Australia, China and Africa. Approximately 500,000 gallons of water get used for every ton of lithium mined. To extract lithium a hole is drilled in salt flats and then the salty, mineral-rich brine is pumped to the surface\textsuperscript{19}. The water then evaporates after several months, which leaves lithium and other minerals. Some Lithium mining companies have been accused of contaminating water supplies, damaging the landscape and wasting precious water resources. In Chile’s Salar de Atacama, lithium mining consumes 65\% of the region’s water. The problem is so bad that farmers and other people in the local communities must get water elsewhere\textsuperscript{20}. This not only creates environmental damage but human rights issues as well. The United Nations also declared that “having a clean, healthy, and sustainable environment is a human right.”\textsuperscript{21} Lithium and cobalt mining violate this by causing water, air, and soil contamination.
IX. Lithium Recycling

There is also a need for more recycling facilities in the United States. We are wasting so many of the valuable elements contained in lithium-ion batteries. Lithium battery components can be recycled, but this does not mean that they are. Due to the complex material in these batteries, there are many challenges to overcome in the lithium-ion recycling process. Lithium-ion batteries are materially complex and come in a variety of shapes and sizes; this creates a challenge for recycling facilities because they must have tailor-made operation in order effectively recover and process recycled materials so that they can be reused cost effectively. A typical EV battery weighs one thousand pounds and contains twenty-five pounds of lithium in over six thousand individual cells. Current technology is very expensive and relies on harsh
chemicals and high temperatures to break down lithium-ion components. There are very few facilities set up for lithium recycling operations and research shows that as of March 2022 only 5% of used lithium-ion batteries are recycled in the United States. Research also shows that there are currently one million electric vehicles on the road in the United States today and that number is expected to reach 210 to 330 million by 2050. Hopefully, the scale of recycling of lithium-ion batteries will expand rapidly in coming years. There are growing numbers of both government and private sector initiatives to promote recycling in the United States. Studies show that recycling has the potential to reduce the cumulative demand for lithium, cobalt, and nickel needed to electrify the transportation sector by up to 30 percent between 2020 and 2050.

X. Conclusion

In conclusion, the electric vehicle industry has not properly planned for the future of electric vehicles in order to make a swap from internal combustion vehicles a reality. Although it is a viable option for the future, unless an alternate power source than lithium is discovered and the infrastructure quality dramatically increases, there is no way our society is ready to support a world of total electric vehicles. Lithium mining is detrimental to our planet and its inhabitants. It rapes the earth and destroys natural resources as well as violates the basic human right of access to water. It is not recycled the way that it should be and is filling up landfills which leak their toxic chemicals in the earth. The price of lithium is steadily rising making it no longer a cost-effective method of powering vehicles. How can all these challenges to the “green” world we strive towards be overcome? An alternate should be developed because if we continue in the direction we are moving, lithium is not the way. The environmental repercussions will make it impossible to sustain lithium production into the future until a suitable large volume alternative and the ability to mass produce it becomes a reality. Electric vehicles are the future, of that there is no question, but there are too many hurdles to overcome within the foreseeable future for large volume use in our global society.
References


Charts & Tables References


