Electric Vehicles in United States

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Introduction

Electric vehicle (EV) infiltration in the US market has seen some promising results and has become a hot topic. With new players entering the market all the time, newer technologies have led to a boom in electric vehicle adoption. Battery technology, which has been a significant hindrance in electric vehicle adoption, has been rapidly improving with more energy packed into smaller spaces. Additionally, tax incentives from the government have made consumers more willing to buy higher priced electric vehicles.

In the long run, as more infrastructure for EVs is built, there may be even more widespread adoption of electric vehicles. The marketplace is very reliant on both consumers and manufacturers to work together to make sure the technology created is most efficient and effective. As more people buy electric vehicles, manufacturers will be able to produce more cars at a cheaper cost, which ultimately allows more people to buy these cars.

There are certainly many issues that still prevent mass adoption of EVs at this time. Issues ranging from different charging standards offered by companies, such as Tesla's Superchargers, to the relatively high expense of owning an EV, to car owner concerns like range anxiety and practicality.

This report addresses the current technologies available in the market and how newer technologies, infrastructure, business models, and incentives will influence the future of the electric vehicle market in the United States.

Aim

The aim of this research is to provide a preliminary updated understanding of EVs from many angles including specifics of modules, stock markets, business models, battery types, charging, maintenance, government policies for EV researchers.

For consumers, the research provides a thorough knowledge of benefits and drawbacks of having an electric vehicle. For example, consumers will know how much time they need to charge their EVs, how convenient to charge in each state, and how much they will save from EV's simpler mechanical structure and deductible tax.

EV Models

41 Models of **15** Brands

466 Miles - Longest Range
Clarity FCV

80 Min
- Approximate time needed for DC fast charging to charge a car to 80%

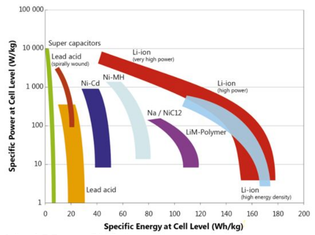
$21,120
- Cheapest price among all Models

Innovation in Battery Technology

While the battery is hidden from view, the details and inner workings of the battery play a key role in determining the overall performance of the vehicle. Over recent years there have been major innovations in this field that have proven to be capable of reshaping the EV market altogether

Lithium-Ion

Lithium-Ion variety batteries have one of the highest energy densities in comparison to other developed battery technology today. It can deliver up to three times the amount of voltage than other batteries like NiCd or NiMH, which means that it delivers higher amounts of current for greater power applications. (Clean Energy Institute, 2018)



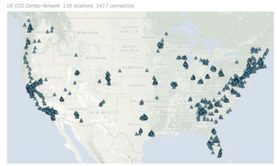
Lithium Air/ Nanolithia

- Lithium Air batteries are capable of holding up to five times more energy than Lithium-Ion. This new technology uses a combination between the lithium on the anode with the oxygen in the air, thus producing lithium peroxide.
- MIT has developed/studied a new battery concept under the title "nanolithia cathode battery". This technology utilizes miniscule nanolithia particles at the nanometer scale, that contain the lithium and oxygen creates in a glass form. These particles remain stable because researchers embedded them within the matrix, a sponge-like material with nanometer sized pores. Includes a variation of the battery chemistry comparable theoretical performance to that if lithium-air, with less drawbacks. Similar chemical reaction between the lithium and oxygen, but during the process, the oxygen never reverts into a gaseous form. (Chandler, 2016)

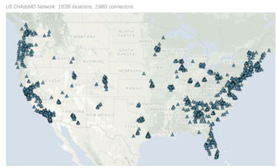
Charging Stations

Electric Vehicle Service Stations (EVSEs) are becoming more accessible to Electric Vehicle (EV) owners. The maps below are from April 2017 showing existing stations.

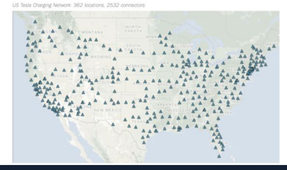
The map below points out the 116 US CCS stations. The CCS (Combined Charging System) includes the classic Type 1 J1772 plug and Combo connectors used by most electric vehicles in the U.S., other than Teslas. The West Coast Electric Highway Project is evident on the west coast, stretching from Washington to southern California. Stations are clustered around major cities.



The second map displays all 1639 CHAdeMO station available. There are over 10 times as many CHAdeMO stations as there are CCS.

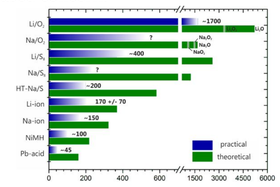


The final map shows the 362 Tesla stations in the U.S.Contrary to the other connection types, Tesla spaced out their stations evenly along many major interstates. Also note that the number of connectors is about 8 times the amount of locations, due to Tesla implementing dual port EVSEs and better equipped stations.



Nanolithia Cont.

This process reduces the voltage loss by a factor of five, originally 1.2 volts to .24 volts, therefore only 8% of the electrical energy is turned to heat. The approach of non-state changing chemicals also decreases the amount of huge volume changes that may disrupt electrical conduction paths. This allows for faster charging cars due to the fact that heat removal from the battery pack is a decreased concern.



Range Anxiety

Range anxiety is a possible barrier for the widespread endorsement of EV's. It is defined as stressful experience of a present or anticipated range situation, whereby the range resources and personal resources available to effectively manage the situation (e.g., increase available range) are perceived to be insufficient.

Reasons for range differences:

(a) individual differences (e.g., personality traits, trust in the EV and its functions)
(b) system features (e.g., support through advanced information technology and assistant systems, availability of fast charging stations in route)
(c) environmental factors, like daytime (day vs. night) or regional structure (urban area vs. rural area).

Tax Incentives

Economic enticements aimed at electric car consumers are vital for decreasing the buying price and total cost of ownership (TCO) gap between electric and traditional cars. They are important to a variety of stakeholders ranging from private consumers to company owners using business vehicles.Most announcements will argue the "automobile is entitled to a tax credit of up to $7,500," but in actuality that is not always the case. The national electric car tax credit is only obtainable on specific electric and plug-in hybrid vehicles, and the full quantity obtainable on any car is centered on the size of its battery pack. Though all battery-electric vehicles currently offered for sale are worthy for the full amount, not all plug-in hybrids are.

Conclusions

In the recent years, major advancements have occurred in the EV market. Batteries are being developed with higher energy density, resulting in longer ranges and at the same time, charging time is reducing due to higher power output. These technological improvements combined with the public's increasing approval of EVs through tax incentives and a decreasing presence of range anxiety due to the construction of more charging stations is creating a favorable market for EVs. Ensuring the large scale adaptation of EVs will involve further technology improvements, standardization, and consumer education.

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