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A Study of Factor Leading to the Popularity of EV

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Abstract-

In the present world where environment protection and energy conservation are major concerns, the development of hybrid vehicles and electric vehicles has taken an accelerated pace. The increasing interest in e-mobility and related developments has increased the need for academic and industrial involvement. This paper reviews the present status of electric and hybrid vehicles around the globe and the state of art technology and engineering. The need and importance of the collaboration of technologies of automobile, electric motors, drivetrains, batteries, electronics and controls, as well as, the need of collaboration between the government, industry, research institutions and electric power utilities are addressed. The challenges related to the infrastructure needed for the ease of use of electric vehicles is also mentioned.

INTRODUCTION

During the next two decades, there will be a significant change in the way people and commodities travel, as a result of a mix of policy, technology, economics, demography, and shifting consumer preferences.

Electric vehicles (EVs) were initially developed in the middle of the 19th century, a period when electricity was one of the most popular forms of motor vehicle propulsion. At that time, gasoline-powered automobiles were unable to match the degree of comfort and simplicity of operation that electric vehicles offered. Since over a century ago, internal combustion engines have dominated motor vehicle propulsion, while other vehicle types, such railways and smaller vehicles of all kinds, have continued to be primarily powered by electricity.

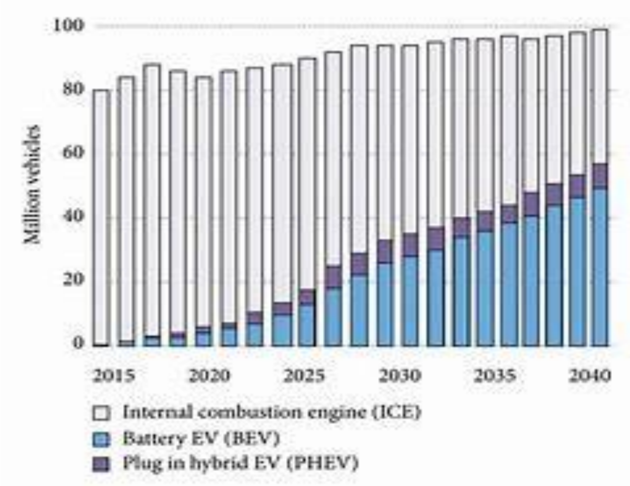
EVs saw a renaissance in the twenty-first century as a result of technology advancements and a greater emphasis on renewable energy. While there was a significant increase in demand for electric cars, a tiny group of do-it-yourself (DIY) engineers started exchanging technical information on how to convert existing vehicles to run on electricity. The introduction of government incentives to promote adoptions occurred everywhere. From 2% of the market in 2016 to 22% in 2030, it is predicted that electric cars would grow.

The advantages of electric cars over conventional internal combustion engine vehicles are discussed in this article along with the technology behind them. The difficulties encountered in advancing e-mobility worldwide are also covered.

The introduction of the article reviews the current state of EVs and HEVs before moving on to the technical approach to EV development. It then addresses the key technologies before getting to the commercialization details.

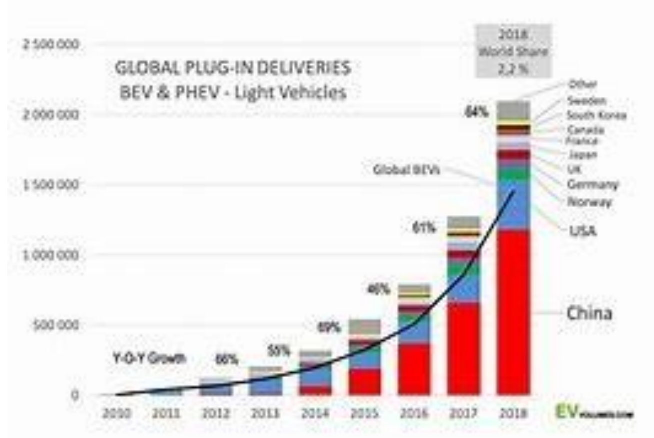
ELECTRIC MOBILITY IS ADVANCING AT A SPEEDY PACE

For the first time, new electric vehicle (EV) sales worldwide surpassed one million units in 2017. By 2020, EV makers may almost treble that success and sell 4.5 million vehicles, or about 5% of the whole global light-vehicle market, if they continue on their present growth trajectory. By 2025, 28 million will have purchased EVs annually, and 56 million will have done so by 2050.



With approximately 1.1 million electric vehicles sold in 2018 and 2.3 million units, the Chinese market continued to be the biggest market for electric vehicles worldwide. It also represented almost half of the world's total electric vehicle stock. It increased by 72% in 2017, which strengthened China's position as the market leader for EV sales. The nation currently has a bigger EV market, dominated by BEVs, than both Europe and the US put together. Domestic Manufacturers now control the majority of the Chinese EV market, with a sales share of around 94 percent.

Europe came in second with 1.2 million electric vehicles on the road, while the United States came in third with 1.1 million vehicles on the road at the end of 2018, respectively, with market growth of 385 000 and 361 000 electric vehicles from 2017. With 46% of its new electric car sales in 2018, Norway led the world in terms of market share for electric vehicles. This was more than twice Iceland's second-largest market share of 17% and six times Sweden's third-highest market share of 8%.



At the end of 2018, there were around 300 million electric two- and three-wheelers on the road. China accounted for the great bulk. The Chinese market for electric two-wheelers is hundreds of times bigger than any other market in the world, with annual sales in the tens of millions. With over 460,000 electric buses on the road in 2018, over 100,000 more than in 2017, the industry continues to see rapid growth. In 2018 and the beginning of 2019, "free floating" electric foot scooters became increasingly popular in big cities all around the globe. These foot scooter programmes are now available in around 129 American cities, 30 European cities, 7 Asian cities, and 6 Australian and New Zealand cities. LSEVs (low-speed electric vehicles)* were predicted to have sold 5 million units in 2018, an increase of around 700,000 units from the previous year. There were just LSEVs in China.

EV-RELATED POLICIES

Throughout the last five years, the European Union has enacted a number of significant measures. Some of them include providing financial assistance by way of non-reimbursable grants from the Connecting Europe Facility (CEF) for the development of charging infrastructure, support to projects focusing on research and innovation in electric mobility from the EU's Horizon 2020 or the European Investment Bank, and incentives to promote the purchase and use of EVs.

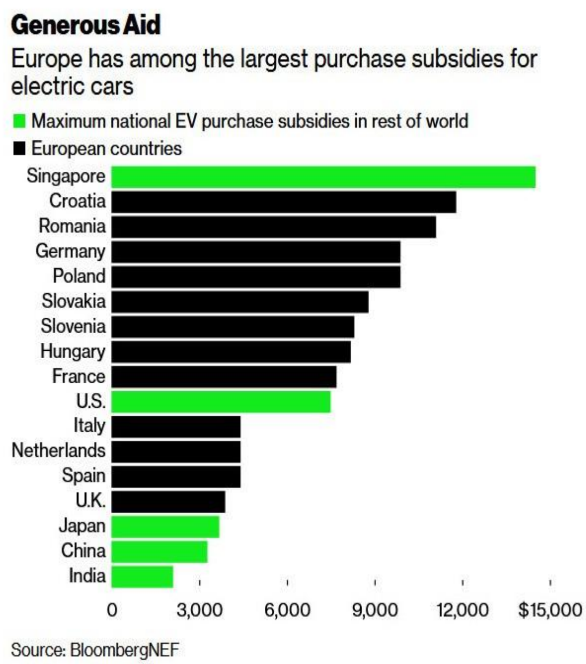
Phase II of the Faster Adoption and Manufacture of Electric Vehicles in India (Fame India) programme has been authorised by the Indian government. The program's goal is to hasten the adoption of electric and hybrid cars by providing incentives for their purchase and by building the required infrastructure for EV charging.

Japan hopes to electrify all of its vehicles by the year 2050 and cut its greenhouse gas emissions by around 80% per vehicle, including about 90% reductions per passenger car, via cooperation between the government, manufacturers, and material suppliers.

To foster a more competitive market for Chinese automakers, China has pledged to lift its restrictions on foreign investment in the sector. China has introduced a dual credit regulation system that awards or penalises manufacturers with positive or negative credits depending on the fuel efficiency and range of their automobile models.

In order to encourage the purchase of EVs, the government of Korea offers a variety of benefits to EV owners, some of which include a 50% decrease in highway tolls, discounts for using public parking lots, exemption from paying the energy base price, and subsidised quick charge rates. By 2022, the government also intends to continue providing incentives for electric and hydrogen-powered cars.

The development of policies is being seen in nations like Chile. After China, Chile boasts one of the biggest fleets of electric buses. By 2040, it hopes to electrify all of its public transportation, and by 2050, 40% of its private transportation. By 2050, New Zealand also plans to use only electric vehicles.



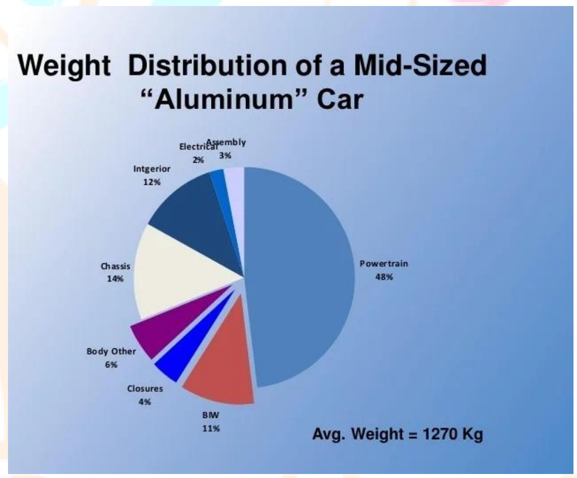
TECHNOLOGICAL DEVELOPMENTS

The four issues that have been constantly mentioned—cost to purchase, range, recharging, and time required for recharging—are beginning to be solved by the newest generation of electric cars thanks to advancements made by manufacturers. In addition to being reliant on ongoing improvements in the automobile industry, such as changes to battery chemistry, energy density, battery size, and manufacturing industry scale, the cost is also projected to decrease.

The vehicle production platforms have been optimised to take use of the more inventive and straightforward design architecture and the lower number of moving components than in ICE cars as major improvements to save costs.

Due to the increased interest in EVs for heavy-duty vehicles like trucks and buses, technological advancements in chargers have been seen. 'Ultra-fast charging' is anticipated to enable EVs to add 300 kilometres (about 186.41 mi) of range in five to ten minutes when the longer range models become more affordable. While the electrification route is not yet obvious, longer range electric freight trucks will be the main adopters of this technology. Specifications for ultra-fast chargers between 150 and 350 kilowatts have been established which will reduce the typical charging time to 5-20 minutes.

Manufacturers of electric vehicles have been waiting impatiently for a battery innovation that would extend both the life of the battery and the range of the cars. High-density lithium-ion batteries are being created by new businesses like Neolith in order to address both of the aforementioned issues. The business claims to have created the first 1000 watt-hours per kilogramme (Wh/kg) in history. The batteries of the Tesla Model 3 are 250 Wh/kg and utilise 2170 cells. An electric vehicle can go 1000 kilometres (approximately 621.37 miles) on a single charge thanks to a battery of such density. With its top-tier models, Tesla's batteries can provide a range of 531 kilometres (approximately 329.95 miles).



CHALLENGES FACED ATCURRENT SITUATION.

The development of EVs with more range, more power, and premium aesthetics is progressing thanks to the car industry. In order to sustainably accelerate the expansion of EVs, the industry still faces several obstacles.

One of the primary barriers preventing consumers from purchasing electric vehicles is the absence of public rapid charging facilities. While many BEVs can be charged at home, owners who travel long distances or who cannot charge their EVs at home should consider investing in public fast-charging infrastructure. Seven times less than petrol stations, there are just 16000 public charging stations in the United States. Less than 2000 of them provide quick charging since they are costly and less lucrative because there aren't enough transactions to break even. Without assurances that there will be sufficient charging stations to refuel their EVs in case they run out of power, people will be hesitant to purchase an EV. Nevertheless, it won't be financially viable to install a charging station until more EVs are sold.

Another significant issue is the car original equipment manufacturers' earnings being squeezed as a result of EVs and other cutting-edge technologies (OEM). Every year, more money is invested in the development of EVs, and growing losses are related to most EV models' negative margins. Yet, these issues may be overcome by redesigning the platforms on which the EVs are manufactured and working in collaboration with other manufacturers.

CONSIDERATION OF POLICIES.

The growth of the battery sector value chain depends on increasing legislative support for the optimization of the value chain and establishing a framework that lowers investment risks. The governments have to concentrate on boosting capacity and investments with significant stakeholders. The distance between educational institutions, training facilities, and the battery business must also be bridged.

The availability of raw materials must be carefully considered due to the rising demand for raw materials for EV batteries. Governments must find out how to increase their openness if they want to resolve the serious problems in the supply chains for the raw resources.

In addition to adopting car and pricing regulations, the policies created by the nations should provide a roadmap and define goals.

People are encouraged to purchase EVs by economic incentives, even though they are more expensive than cars with internal combustion engines. The infrastructure for charging stations must be put up in the same way.

Public charging station installation in cities and on highways is essential for expanding EV adoption and enhancing customer trust.

Procurement programmes are crucial for generating interest in EVs and motivating the car industry to enhance production. They also assist in enabling the public charging infrastructure's first rollout.

CURRENT POLICIES

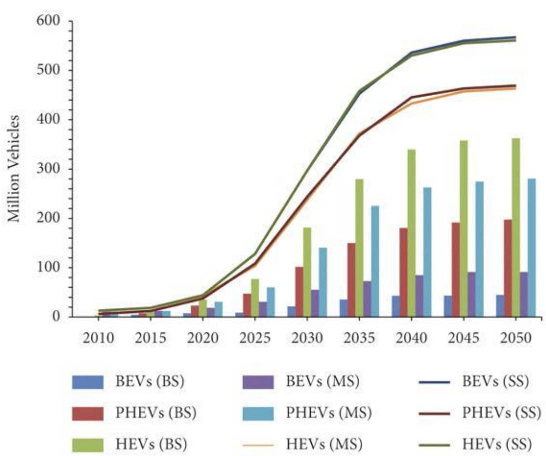
Every government in the world is pursuing policies to encourage the use of EVs, first beginning with a vision and establishing goals. Adopting electric cars and creating the necessary infrastructure is the first step. The desire for more electric vehicles on the market and the early rollout of publicly accessible charging infrastructure are both sparked by procurement programmes that drive the auto industry. Governments often provide financial incentives, mainly to close the price gap between EVs and ICEs (internal combustion engines) and to encourage the early installation of charging infrastructure. Economic incentives are often combined with additional policy measures that enhance the appeal of EVs (such as exemptions of access restrictions, reduced tolls, or free parking), which are frequently predicated on EVs' superior performance in terms of reducing local air pollution. Fuel efficiency regulations, zero-emission vehicle mandates, and the raising of the ambition of public procurement programmes are measures that offer essential incentives to scale up the availability of cars with low and zero tailpipe emissions. The deployment of publicly accessible chargers in cities and on highway networks, as well as requirements for interoperability and minimum availability levels for publicly accessible charging infrastructure, are some of the regulatory measures related to charging infrastructure. Minimum standards to ensure "EV readiness" in new or renovated buildings and parking lots are also included. The deployment of EVs and charging infrastructure has only been seen so far in Norway, but as the markets and infrastructure develop, certain legislative measures may need to be altered. One example is the way that gasoline and car taxes are changed and how much money they bring in for the government.

Leading nations in the race, such those taking part in the Electric Vehicle Initiative, have made tremendous strides since beginning to enact EV policies. A few of the processes include the creation of standards, public procurement, the implementation of early billing, and financial incentives. Several of these nations have regulatory frameworks in place, and some developed markets, like Norway, have begun to phase down specific EV support measures.

The Demand of EVs.

1 Future Global Demand for EVs

The first stage in choosing the base metals for energy-based transportation in the future is to set up a scenario where the quantity of EVs and the ensuing metals' demand can be predicted. With regard to historical (2010) and future (2050) year scenarios, such as baseline (BS), moderate (MS), and stringent (SS) results, Figure 4 depicts the yearly growth of three various kinds of EVs (BEV, PHEV, and HEV). The integrated model to analyse greenhouse impacts (IMAGE), which was created for the database of the common socioeconomic pathways, provided the data necessary to make improvements to the situation (SSP). An SSP is a persistent problem that enters the network as a result of environmental changes. They are reliant on five various accounts, which convert into quantitative projections of the three main financial variables of population, currency flows, and urbanisation.



The absolute number of drivers in the basic scenario is predicted to increase from 1.13 billion in 2011 to 2.6 billion in 2050 based on the results of improving the situation. By 2050, there will probably be 2.25 billion and 2.55 billion station waggons worldwide, respectively, depending on economic circumstances. It demonstrates that in all three situations, the supply of three EVs rose from year to year even under trying circumstances.

2 Electricity Demand for EVs

Under the new political scenario, the demand for EVs is predicted to be only around 640 terawatt-hours (TWh), and in 2030, the light-duty vehicle (LDV) will be the biggest pantograph of all EVs. EVs are increasingly suited for power supply systems, as shown by the facts, so make sure that management does not prevent their usage by requiring electrical structures. Globally, slow chargers that may be utilised to provide flexibility services to power networks are predicted to consume more than 60% of all electrical energy by the year 2030. Fast charging demand times, such late at night, may adversely influence the power structure's pile form

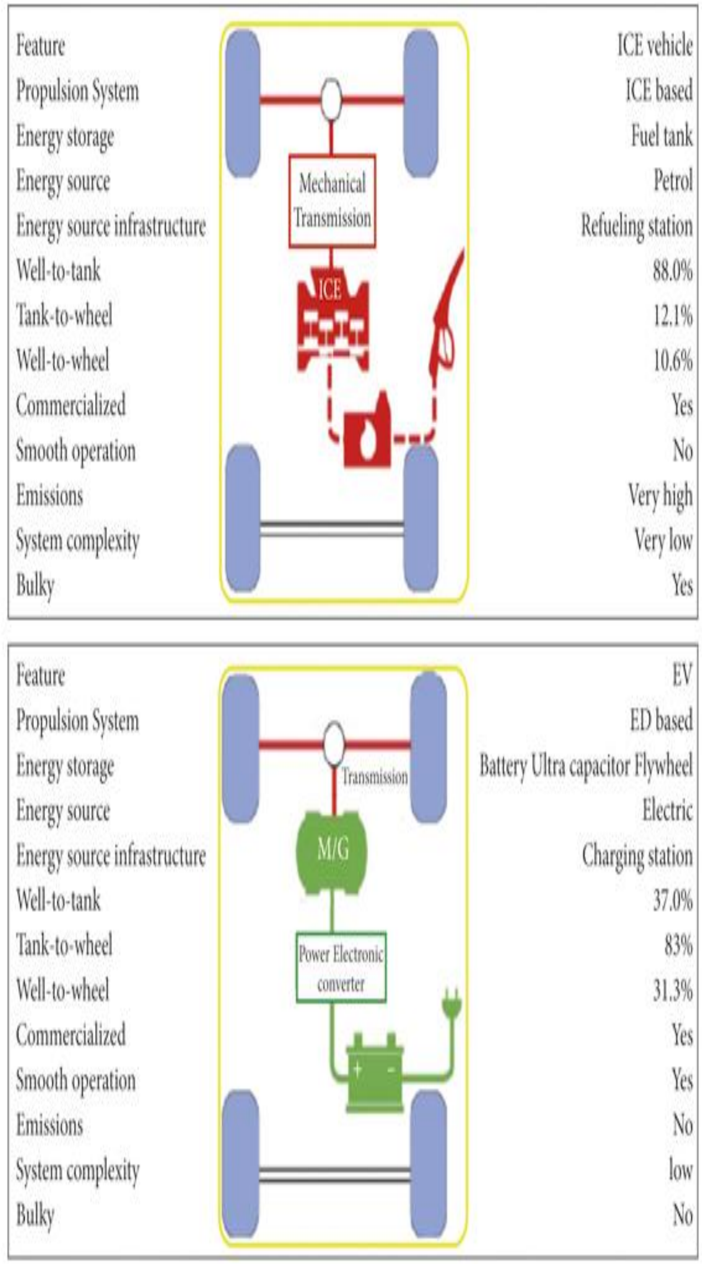
3 Battery Demand for Electric Cars.

The popularity of electric vehicles (EVs) and the necessary conditions for battery manufacturing show that novel materials are increasingly appealing to the automotive industry. Nevertheless, interest in both cobalt and lithium could rise by 2030. In general, the capacity to manage investment in metals, particularly cobalt, is influenced by cathode science. To achieve the anticipated EV absorption rate, it is required to enhance the cobalt and lithium reserves. A rise in the availability of raw materials is also indicated by the size of the raw material interest adjustment for EVs. Raw material challenges are mostly linked to the development of innovation, environmental effect, and social problems. By preserving the actual mining of minerals, the identity and directness of raw materials are crucial methods to address some of these critiques.

EVs Next-Generation

1 EV and HEV Unit Design and Advanced Unit Development.

Battery EVs (BEV), hybrid EVs (HEV), fuel cell vehicles (FC), fuel cell hybrid EVs (FCHEV), and hybrid solar EVs are the primary EV types that compete with ICE cars (HSEV). summarises the corresponding ICE car and charging vehicle examinations and displays the architectures. Reduced prices, increased productivity, and the development of innovative electric driving technologies should be the main areas of attention for the creation of environmentally friendly automobiles putting high power density into practise. The development of the important authorizations that may enhance the performance of the aforementioned engine can be summed up as follows.



Future Recommendation

It is believed that the unique ideas may be helpful to overcome the barriers to EV development after analysing the most recent research on the state of electric cars (EVs). Also, discussing all the relevance in one research is intolerable. The study requires some future suggestions for illuminating its usefulness for further enhancement, as provided below.

1-The energy storage battery technology needs to be improved for EV adoption, as well as the need to enhance the standard charging ports to be user friendly.

2- The materials used in EV batteries are challenging to recycle. So, there is a need to find a new energy storage technology.

3- EV battery charging with grid connection still has adverse effects. These effects may need time to be reduced, which will increase a great chance to integrate EVs with renewable energy sources.

4- Develop new EV business and policy plans for customer's products and services about EVs.

5- Globally, EV acceptance still needs time. EV implementation can be improved by following some EV-accepted countries.

6- The information and communication should be more advanced in EV smart cities with renewable energydevelopment. To make the right plan, we need to collect more literature or online survey data, and the idea can generate from EV-developed countries.

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