



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## A Study On Electrification Of Automobile: Navigating Future Challenges And Understanding Consumer Perspectives.

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### Abstract

This report presents all the information, knowledge, learning's I got from my research of 93 days the study provides an insight on Electrification of Automobiles the way the vehicle are made and navigating its future challenges and also getting to know the consumer perspective . Visited the manufacturing unit for better understanding . Electronic vehicles will create a great impact in reducing air pollution .In this paper EV's , Batteries , recharging stations will also be explained .

### Introduction

#### Introduction to Electric Vehicles

An electric vehicle (EV) is a vehicle that uses electric motors to drive itself. A collector system allows it to operate on energy from sources external to the car, or it may convert gasoline into electricity using its own battery, generator, or fuel cells.[1] A wide variety of vehicles, including automobiles, trains, spacecraft, aircraft, boats, and submarines, may be considered electric vehicles (EVs).

Early electric vehicles first debuted in the late 19th century, coinciding with the electrification that the Second Industrial Revolution brought about. One of the most popular ways for motor vehicles to be propelled was by electricity since it provides some advantages over gasoline-powered automobiles, such as being more comfortable, quiet, and easy to operate. The limited energy storage offered by existing battery technology, however, caused range anxiety, which slowed the broad adoption of private electric cars during the 20th century. For around a hundred years, gasoline and diesel internal combustion engines were the standard for vehicle propulsion. Nonetheless, there are still a number of vehicle types that rely on electricity for propulsion. These include electric trains, trams, monorails, and trolley buses, which are all powered by overhead lines. Another kind is mobility scooters, which are tiny, battery-powered personal vehicles with a limited range and low speed.

Electric motors supplemented internal combustion engines to create hybrid electric cars, which were popular in the late 90s. Not until the late 2000s did battery electric cars become a practical option for consumers. Even later, plug-in hybrid electric vehicles, which use electric motors as the main source of propulsion instead of an afterthought, were not mass-produced.

With the development of better batteries, electric motors, and power electronics, electric vehicles have become increasingly practical in recent decades. To reduce greenhouse gas emissions and other pollutants from vehicle exhaust and to increase the use of alternative fuels, some local governments provide subsidies to purchase electric cars and trucks.

### History of Electric vehicles

The late 1820s and early 1830s saw the invention of the first crude electric carriages. The 1890s saw the introduction of the first practical, mass-produced electric vehicles. The land speed record was held by an electric automobile until about 1900. Due to their high price, low peak speed, and short range in comparison to cars powered by internal combustion engines, the use of battery electric vehicles as private motor vehicles declined over the world around the turn of the twentieth century. There are still many uses for electric vehicles in the public transportation sector, including but not limited to rail trains, loading and freight equipment, and others.

A dramatic increase in the number of people opting to drive electric or alternative fuel cars occurred in the early years of this century. Among these considerations were developments in electric vehicle technology, rising environmental concerns about hydrocarbon-powered cars and their accompanying difficulties, and doubts about the long-term viability of the existing hydrocarbon-based transportation system.

By the end of 2019, there were 4.8 million electric vehicles on the road[2]. By the end of 2020, sales of light-duty plug-in electric automobiles had surpassed 10 million units. There has been a cumulative sales total of one million units of electric automobiles and utility vans worldwide since 2010 as of September 2016[1].the third The worldwide sales ratio of battery electric vehicles relative to plug-in hybrids rose from 56:44 in 2012 to 74:26 in 2019.

### Designing and Manufacturing of Electric vehicles

While there are certain critical areas where the production process for electric automobiles differs from that of traditional cars, overall, there are some similarities. The engine and battery are the key points of distinction. An electric motor powers an electric car rather than a gasoline or diesel engine. To make sure the battery and electric motor in an electric automobile are operating properly, further testing is necessary. Regarding the manufacturing process itself, the fundamental phases in production differ between manufacturers, yet the main procedures required include those mentioned below.

## The Gear box

A basic step in engineering a gearbox is constructing its housing. They secure the transmission's bearings with grease by means of a plastic tube and a brass fitting. After the bearings are installed, a parking pawl, which locks the gearbox, is fastened. A single-speed gearbox with four helical gears is housed in the gearbox's second half. This design feature allows for a seamless transition between gears and a progressive engagement thanks to the angled teeth.

## The Driving Force

The rotor and stator are two of an electric car's most crucial components and play a major role in how they are manufactured. Each of them is an electromagnet. The magnetic fields interact when the rotor is put into the stator. This produces the torque necessary to move the automobile forward and backward by converting electrical energy into mechanical energy. This is now fastened to the drivetrain, sometimes referred to as the gearbox assembly, and cables are installed to control how much battery power is sent to the motor.

## The chassis

The drivetrain is lowered into the back of the car's body and bolted into place, and the chassis is pre-assembled. The independent suspension and driving axle are then mounted to the gearbox. This enables the vehicle to respond, wheel by wheel, to road irregularities.

## The battery

The battery, sometimes called the powertrain, is the most important part of an electric car's construction. It powers an electric vehicle's motor. Instead of a typical TV remote control battery, it is made up of nearly 7,000 lithium ion cells. In contrast to conventional automobiles, which have the engine lowered into the engine compartment, electric cars require the car to be lowered onto the battery pack due to their large battery packs!

## The wiring

The power electronics module, which is the brains of the car, is connected to all the wiring that powers the lights, fans, and other electrical parts. This is mounted above the drivetrain and changes the battery's DC electricity into AC current, which powers the motor as the driver accelerates.

## The Coolant

The next step is to construct a vacuum system to extract air from the battery and then pump in liquid coolant such that the temperature remains consistent across the whole block of batteries.

## The car itself

On a production line, the interior and outside of the automobile are put together at the same time, together with the seats, instruments, lights, ignition, and charging station. The automobile is checked and driven after

everything has been assembled and installed to make sure everything is operating as it should. The car is signed off and prepared for delivery to the showroom or to the customer directly after quality control. This completes the process of creating an electric automobile.

### Future of Electric vehicles

While electric vehicles aren't going anywhere anytime soon, Kiplinger claims that gas-powered cars' internal combustion engines are becoming obsolete. A great deal of adjustment is necessary before electric vehicles can meet the aspirations of the future. Rapid growth in both charging infrastructure and battery manufacturing is required for EVs. Moving forward, the car industry must adopt a foundation for fully electric vehicles. Above all else, it is crucial that buyers push for these upgrades and rally behind electric vehicles.

### Growth estimates for electric vehicles

The International Energy Agency (IEA) reports that 6.6 million electric cars were sold in 2020, with a sales share of more than 9%. In 2021, that figure almost doubled, reaching 16.5 million vehicles on the road. That number does not include hybrid electric vehicles (HEVs), which may use either electric or gasoline power.

That may not seem like much, but experts in the field say the rate is really going up. By the end of 2024, there will probably be more models than ever before, with more than 100 EV models available, according to our colleagues at True automobile, an online marketplace for automobile transactions. Protocol states that the proportion of gas-powered to electric vehicles will steadily

- “By 2025, electric vehicle sales could comprise up to 20% of new car sales
- By 2030, electric vehicle sales could reach 40% of new car sales
- By 2040, electric vehicle sales could account for nearly all new car sales”

Many elements will determine the future of electric cars.

The efficiency and speed at which the United States adopts electric vehicles is determined by a number of intricate social and economic factors. Before we can expect EVs to replace gas-powered vehicles, automakers, lawmakers, and the majority of consumers must make EVs a priority.

### fleet replacement

The term "fleet turnover" describes the rate at which new cars are added to the fleet. It will take longer for future EVs to displace gas cars since they are more dependable and durable than ever. Ride-sharing services and urban transportation planning are other factors that affect fleet turnover.

### Conversions from auto manufacturers

Automakers are attempting to transition their product lines to all-electric vehicles, however they have different conversion schedules. Some have promised to stop selling gasoline-powered vehicles by 2035; others, if not mandated by legislation, might not get there until 2045 or even 2050.

### Laws

By 2035, the sale of new gasoline-powered passenger cars will be prohibited in many states thanks to legislation that has been passed or executive orders signed by governors. By 2050, the majority of passenger automobiles on the road might be electric if this occurs across the country.

### Infrastructure

We will require the infrastructure to charge electric cars if there are more of them on the road. Lawmakers have enacted legislation to start the lengthy process of deploying chargers across the nation.

### The impact of consumers on the future of electric vehicles

There are still certain obstacles for consumers to go over before the adoption of electric vehicles is predicted to expand exponentially. Several obstacles include the price of ownership, one's driving style, and the concern one has about the distance one can travel on a single charge.

### Costs of electric vehicles

In 2021, the average price of a car was about \$10,000 higher than that of a gasoline-powered vehicle, even though electric vehicles had a reduced total cost of ownership. Home charging stations, electric car batteries, and insurance for EVs may all add up quickly. When the upfront and ongoing costs of electric cars are competitive with gas-powered vehicles, we can expect to see a surge in their adoption.

### Driving customs

Future driving patterns and auto purchases may change as more businesses and employees accept remote work. Individuals with lower driving frequency could be less inclined to upgrade from an older car to an electric one.

### Anxiety range

The phrase "range anxiety" refers to people's worries about running out of battery power and becoming trapped in an electric vehicle. As more charging stations become accessible, this anxiety may subside. Additionally, as batteries get stronger and more people understand that they frequently don't drive far enough to be a concern, these worries will lessen. The adoption rate of electric vehicles may increase more quickly than analysts anticipate if the industry can resolve these issues with promptitude and determination.

### Future of Electric Vehicles In India

India is one of the largest markets for two- and three-wheeled cars globally, ranking in the top five nations for both private and commercial autos.

In FY2022, JMK Research forecasts an astounding 455,733 units of electric car sales. There were 1,334,385 EVs on Indian roads in July 2022, according to data from the country's Ministry of Road Transport and Highways.

These estimates are expected to increase due to the strong push for more electrification of roads in India by the federal, state, and commercial sectors.

### India Establishes High Goals

Union Minister Nitin Gadkari stated that the goal of the Indian government is to have the following EV mix in India by 2030:

One of the policies and programs that the Indian government has created to assist in reaching these ambitious objectives is the National Electric Mobility Mission strategy (NEMMP), which is an all-encompassing plan to encourage the use of electric cars in India. The objective is for India to use less crude oil.

An further program that the Indian government created is FAME, which stands for Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles. This plan should lead to increased adoption in the next years. The Indian minister of finance has also announced a reduction in taxes and customs charges for the fiscal year 2023. Domestic production of lithium-ion batteries for EVs will rise as a result of this.

A number of state governments have also come up with attractive policies and programs to promote the manufacturing of electric cars in their respective areas. These include the governments of Gujarat, Telangana, Tamil Nadu, and Assam.

Increased adoption of electric vehicles in India is a direct result of these strategies, which have attracted private enterprises to the EV industry. Internationally, everyone stands to gain a lot from India's progress.

### India's Adoption of EVs Will Benefit the World

Market share for EVs more than quadrupled in 2021, reaching 16.5 million units, according to the IEA. Additionally, India has said that by 2023, electric vehicles would constitute a minimum of 30% of all road traffic in the country.

Firstly, India is the world's third-largest oil importer at the moment. However, its dependence on oil will be significantly reduced when it adopts electric cars, which will disrupt global oil markets. India hopes to set an example for other developing countries to follow if it achieves its ambitious adoption targets. Therefore, when this fossil fuel is used less often, the oil markets will feel the effects even more acutely.

In addition, with its rapidly growing economy and population of over 1.4 billion, India is poised to become a key participant in the worldwide electric vehicle industry. By going electric car crazy, India will be leading the way in sustainable transportation development on a global scale.

### Effects on Environment

India's transition to electric cars will have a big effect on the environment. India's transportation industry currently contributes significantly to pollution. Consider the nation's capital, New Delhi, where 50% of the surface PM 2.5 levels are caused by two- and three-wheelers.

Additionally, the transportation industry in India uses around one-fifth of the nation's energy. These figures suggest that EVs can significantly affect India's environment in the following ways.

#### 1. Diminishing Air Congestion

Vehicle emissions are the direct cause of 1.2 million annual deaths and 27 percent of India's total air pollution. As a result, the adoption of electric cars in India would significantly reduce the global environmental impact of ICE automobiles.

## 2. Diminishing Disturbances

India faces a significant problem with noise pollution as a result of growing urbanisation, which increases demand for automobiles. Five Indian towns are listed among the noisiest cities in the world in the UNEP study from 2022. EVs are expected to reduce noise levels since they lack the mechanical valves, gears, and fans seen in conventional internal combustion engine (ICE) vehicles, even though vehicles are not the only source identified in the research.

## 3. Increasing Efficiency in Operations

In terms of fuel economy, EVs may convert 60% of the electrical energy from the grid, compared to just 17 to 21% for gasoline or diesel vehicles. It is obvious that India's move to electric cars would increase fuel output and optimisation efficiency. It will increase demand for EVs by lowering end-users' operating expenses.

In addition to the previously mentioned environmental benefits, India will benefit economically from the widespread use of EVs.

## India's Economic Prospects

Apart from signifying noteworthy advancements towards an environmentally sustainable future, the complete electrification of India would yield advantages for enterprises, financiers, and end-users locally. We've highlighted a few of the more intriguing prospects below.

### 1. Owners of Fleets

Companies like Amazon, DoorDash, and Big Basket may save costs by switching to electric cars for their fleets. A two-wheeler fueled by gasoline has a Total Cost of Ownership (TCO) of Rs 2/km in New Delhi, as reported on Weforum.org. You may reduce this cost to Rs 0.52/km by switching to electric automobiles. But the shift to EVs is moving at a far slower pace than in the US or Brazil. Many Indians remain wary of electric vehicles due to their high sticker prices, poor resale value, and general skepticism of modern technology.

The government is offering tax incentives to lower upfront costs in order to allay these worries. In the interim, pioneering firms are offering sturdy and dependable charging options that will increase trust in this novel technology.

### 2. Manufacturers

Manufacturers have a plethora of options in the EV market to develop affordable automobiles that are competitive for India and the global market. According to research, OEMs can increase the value addition of each EV by 5.7% by 2030. In order to assist OEMs in building the EV ecosystem, the Indian government is promoting the indigenisation of the supply chain through the Atma Nirbhar initiative.

Additionally, businesses in India are working to give OEMs access to features like keyless entry, car diagnostics, and navigation by assisting them in developing a charging app using SDK development tools. All of these actions aid OEMs in providing drivers with on-the-go charging and hasten the transition to EVs.

### 3. The Real Estate Sector:

Since this sector needs EV manufacturing facilities, industrial zones, and charging stations built, EVs present a number of opportunities for real estate investors, brokers, and developers. Since that charging an EV takes 15 to 20 minutes on average, developing retail infrastructure surrounding EV charging stations is also crucial.

According to a Colliers assessment, 1,300 acres will be needed by the EV industry to establish a 110 GWh battery manufacturing capacity by 2030. By 2025, the nation will also require 13.5 million square feet for charging stations. These figures demonstrate the wealth of opportunities that exist for any participant in the real estate market.

### 4. Consumers

India's youthful and vibrant populace is eager to adopt new technology since the nation is witnessing an increasing upward mobility trend. People's socioeconomic standing improves with increasing wealth, which puts them in a better position to buy electric vehicles (EVs).

The government of India, along with other forward-thinking participants in the EV market, is leading efforts to expand the number of charging points in EV charging networks in order to satisfy the increasing demand. Providing software solutions that enable daily charging is one aspect of this.

Using India's skilled labor pool, a number of players are collaborating with companies and governmental organisations to develop creative solutions that have a positive effect on the EV sector. Nitin Gadkari, India's Union Minister of Road Transport and Highways, has forecast that the electric vehicle sector would likely generate five crore new employment opportunities, and the country's youthful workforce is prepared to take advantage of this trend.

There are a lot of possibilities, but the nation still has a way to go before everyone drives electric.

### Challenges for India

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There are difficulties in realising India's promise for electric vehicles. In India, the adoption of EVs is still in its early stages and faces numerous obstacles. The parts that follow will analyse the primary barriers that prevent electric vehicles from being widely used in India. Additionally, we examine possible solutions that might help the country overcome these obstacles and support a more efficient and rapid countrywide adoption of electric vehicles.

#### 1. Insufficient Clean Energy

Burning coal produces a large portion of the electricity used in India. Nevertheless, if all EVs were powered exclusively by coal, the goal of lowering carbon emissions through EV adoption would be undermined. India is looking at renewable energy sources including solar, wind, and nuclear power, according to Nitin Gadkari's speech at the 7th ETAuto EV Conclave. To top it all off, the government is actively supporting the development of biofuels to power electric vehicle assembly plants. The Indian government's initiatives give private companies confidence and chances to use creativity and technology to produce electric vehicles more quickly and for less money. Consequently, this would result in lower initial prices for consumers, which will increase the uptake of electric vehicles in India.



## 2. Inadequate Infrastructure for Charging

Infrastructural issues are preventing India from achieving its objective of using only electric cars. Electric vehicles need a distinct charging and maintenance infrastructure due to the unique design of their engines and other functional components compared to traditional internal combustion engine (ICE) vehicles. But the country's current EV charging infrastructure may not be enough to keep up with the increasing demand.

India now has 934 charging stations, with most of them being located in urban areas. In comparison, there will be 1.8 million EV charging stations in China by the year 2022. In order to build faster charging stations and bigger batteries, it will be need to purchase commercial-grade, high-speed chargers. But you'll have to shell out a big penny to get things started.

Government agencies and private companies are working together to expand the network of charging stations. Many monetary and non-monetary incentives are being offered by the Ministry of Power to encourage the construction of EV charging stations. For instance, the ministry is establishing reasonable fee schedules for both operators and users and implementing a revenue-sharing model for land usage.

Organizations at the federal, state, and regional levels are teaming up with business sector organizations to help establish electric vehicle (EV) stations and charging stations. They are also collaborating with operators to create a Charger Management System (CMS) that will monitor the performance of these stations and, in general, simplify the charging process.

## 3. Inadequate Battery Technology

Since an EV's driving range is constrained, it might be challenging for users to go far between charges. The issue is exacerbated by aerodynamic drag, vehicle weight, battery capacity, and a shortage of charging outlets. This is due to the fact that present batteries are unable to boost EV propulsion and enable greater range due to their small size and low voltage capabilities.

Private companies need to come up with innovative ideas to make batteries that are lighter, have a greater energy density, and can be charged using renewable resources in order to solve this issue. Through tax credits, the government is giving the required push.

The Indian government is also actively promoting battery development under the 2019 National Mission for Transformative Mobility and Battery Storage.

## 4. A Lifelong Ignorance of Change

Consumers in India are still hesitant to buy electric cars, even though doing so would have long-term financial and environmental benefits. The lack of understanding regarding EVs and the general unwillingness to embrace new technologies are the root causes of this problem, especially in rural areas.

Nonetheless, in order to resolve customers' problems, market participants in India must cooperate. Additionally, they want to provide a favourable environment to encourage EV adoption on a large scale in India. This can be accomplished by producing EVs that are more reasonably priced, expanding the infrastructure for charging them, and developing awareness and education campaigns to inform people of the advantages of making the switch to EVs.

## Electric machines, power electronics, and batteries

The use of electric motors and equipment is pervasive in many aspects of modern life, including robotics, consumer electronics, manufacturing, and electric vehicles (EVs) (Zhu and Howe 2007). Enhanced performance, longer lifespans, and lower prices of newer, more sophisticated lithium-ion batteries have contributed to the current uptick in EV adoption. Consumers are showing interest in electric vehicles (EVs) with longer electric ranges, better acceleration, longer cycle and calendar life, and cheaper prices as a result of these improvements in energy and power performance. This section provides an overview of the current status of electric traction drives, electric machines, power electronics, and batteries, as well as research topics, potential future research directions, and metrics for dependability, performance, cost, power density, and efficiency.

## Energy Sources

In 2010, the cost of a lithium-ion battery pack was over \$1,000 per kWh; by the end of 2019, that number has dropped to \$156 per kWh (BloombergNEF 2020). During the same time, the specific energy of a lithium-ion battery cell increased from 140 Wh/kg to 240 Wh/kg, almost doubling (BloombergNEF 2020). Price and performance hikes are mostly attributable to new engineering developments, the use of materials with greater capacities and voltages, and the introduction of methods to promote stability for greater longevity and safety. Enhanced performance and lower costs are also because of improvements to the design of packs, modules, and cells. Increases in production volume due to EV sales substantially help cost reductions (Nykqvist and Nilsson 2015; Nykvist, Sprei

Electric vehicles (EVs) need cheaper batteries and electric machinery and power electronics if they are to compete in terms of pricing with internal combustion engine vehicles (ICEVs). According to the US Department of Energy (DOE), battery prices of about \$100/kWh (preferably around \$80/kWh) are needed to achieve parity (VTO, 2020). By then, EVs ought to be more cost-effective to buy and operate over the course of a lifetime than ICEVs. Significant improvements in EV sales are probably going to result from such cost benefits. Lithium-ion battery pack prices are shown in Figure 3 for both the actual prices from 2010 to 2018 and the projected prices until 2030. According to BloombergNEF, battery pack acquisition costs for OEMs will drop below \$100/kWh by 2024 and reach about \$60/kWh by 2030.

## Charging Infrastructure

The key to promoting EV adoption is infrastructure planning and the establishment of an ecosystem of accessible, affordable, and private chargers (CEM 2020). According to McNutt and Rogers (2004), the lack of a sufficient refueling infrastructure has hindered many previous efforts to promote alternatives to petroleum fuels.

Much study has focused on the many challenges that come with making the shift from ICEVs to EVs, as well as the special function that charging infrastructure performs during this time (Muratori et al. 2020b).

Around 0.9 million of the approximately 7.3 million electric vehicle chargers (or plugs) that were available worldwide in 2019 were located in public areas. Approximately 264,000 public DCFCs were included of this total, with China accounting for 81% of them (IEA 2020).

The public and business sectors are working together to expand the network of public charging stations across the world. The majority of vehicles can be charged at home, and there is around one public charger for every 10 light-duty BEVs. There are 7.2 million light-duty BEVs on the road. The number of public chargers per BEV varies dramatically across the 10 countries with the largest number of BEVs (Figure 5), perhaps because of varying deployment techniques for fast and slow public chargers. There are an estimated 184,000 fast chargers dedicated to electric buses worldwide, with 95% of them located in China, according to the IEA. This number does not include the LDV chargers.

Studies show that most people charge their current electric vehicles at home (50–80% of the time), on the way to and from work (15–25 percent), and at public chargers (5% of the time) (Hardman et al. 2018). Compared to BEVs, PHEVs use level-1 charging more frequently while charging at home (Tal et al. 2019). Multi-unit homes need installations in shared parking facilities or curbside public charging, but single-household detached homes can easily accept level-1 or level-2 charging (Hall and Lutsey 2017).

An analysis of past data by Tal et al. (2019) found that 11% of BEV owners in California used level 1 charging, 72% used level 2, and 17% used DCFCs. Electric vehicles with medium-range capabilities utilize DCFCs at the greatest rate, while those with shorter ranges (less than 100 miles; 161 km) and longer ranges (more than 300 miles; 483 km) use them at the lowest rate.

### Literature Review

#### The "Marketing of Electric Vehicles" study by Garling and Thøgersen (2001)

investigates the possibility of reducing emissions of greenhouse gases and local pollutants caused by the transportation industry by switching from gas-powered to electric cars. Electric car owners, they say, pay a heavy price for these social advantages in terms of accessibility, speed, acceleration, and price. The writers believe that in order to finish the diffusion process, there must be competent marketing and governmental policies that support it. Considering the here and now

#### Afroz(2015)

and associates released a study to look into the ways that people's views and values affect their intentions to buy electric cars. The study's primary target audience is Malaysian customers. In the study, it was discovered that individual consequences (ICNs) with negative correlations to green purchase intention were convenience measurements, product size range, and perceived utility (PIN). When making a purchase, consumers weigh factors like comfort, consumption, and fuel economy, but they may opt for an electric automobile if the manufacturer provides a facility for recycling batteries. PIN has no statistically significant relationship to the environmental effects of ECN.

Karwa(2016)

proposes training and education for dealers of electric vehicles. The knowledge transmission from dealer to client is the barrier to acceptance of electric vehicles.

The primary point of direct interaction for customers is the dealer sales team. Regular use of the vehicles allowed the dealership staff to interact with potential clients and better understand the value proposition of electric automobiles. Electrical infrastructure needs to be installed in both the dealership's front and service areas. Regular training on EVSEs should be provided to dealership employees.

Training should incorporate multimedia resources and condensed one-page sales materials that highlight the benefits of electric vehicles and highlight local incentives and fuel savings.

Monica and Mifzala(2019)

By learning about the attitudes, sentiments, and views of their customers, Monica and Mifzala (2019) looked into how Bangalore's customers were seen. The degree of EV knowledge and the factors influencing customers' purchase decisions were found by the researchers. Most consumers are aware of how environmentally friendly electric cars are. Because of this, half of the clients were concerned about the environment and might prefer to adopt it.

They think that setting up charging stations will contribute to the rise in EV sales.

Parmar and Pradhan's (2021)

research article, "Customer Perception of Electric Vehicles," consumers' knowledge and decision-making criteria for buying an electric car are identified. Their study indicates that most consumers recognize the internet as a major information source in addition to television and print. A number of factors, such as affordability, new trends, noise level, and environmental consciousness, influence consumer behavior. Customers should be able to purchase electric automobiles for less money. There has to be more advertising for government subsidies because consumers are less aware of them.

Singh, Sharma (2021)

and colleagues enumerate the advantages and disadvantages of promoting electric vehicles in India in their research. Among the advantages are the following ones: Electric automobiles are better for the environment than internal combustion engines. Fuel is more expensive than electricity. Maintenance requirements for electric vehicles are lower than those of internal combustion engines. The lack of charging stations, higher cost of electric cars compared to ordinary cars, limited range after charging, and fear of lengthy drives among consumers are some of the issues with electric cars. One thing that keeps people from buying electric cars is their expensive price. In order to combat this, the government has offered incentives to encourage the usage of electric vehicles in commercial vehicles. But electric cars are still relatively new.

## Objective of the study

### Broad objective

Objective of our research is to getting better understanding about the electrification of automobile and to Navigate future challenges .and understanding Consumer perspectives .

### Specific objective

- How to Electric Vehicles are made
- How they effect the Environment..
- Do consumer prefer Electric vehicles or not .
- Understanding the Charging Infrastructure.
- Future challenges for India .
- Economic Aspect of India .
- Estimation of Growth .

### Research Methodology

For the primary study of the report Qualitative Approach was used.Primary and secondary data are the foundation of the report.

Primary data collected by having conversations with people conducting survey .And by observing.

Secondary data is data that has previously been obtained for another reason, and the research process often begins with a review of this data.

### Research Design

As per the report. Ethnography research Design and case study have been used for this report. As the majority of the data was gathered through direct observation, interactions with people and by reading documents.

## Data Analysis

The use of electric vehicles can help improve air quality, reduce greenhouse gas emissions, and more, according to surveys, evaluations, recordings, articles, and observations made online. The substantial investments in electric vehicle (EV) research and commercialisation, charging infrastructure, and other technical advances, especially in battery and associated supply chain areas, are reflective of the future roles predicted by various studies. In a positive feedback loop, technological development, customer approval, and adoption all contribute to a reduction in prices and an improvement in technological components, paving the way for broader usage. It is still challenging to foretell the future, particularly in terms of the acceptance of new technologies. However, this thorough analysis presents a promising picture for EV use in on-road transportation in the future. We believe that obstacles related to technology, laws, society, behaviour, and business models can eventually be removed to facilitate the shift to more economical, environmentally friendly, and efficient transportation options for everybody.

The pie chart given below shows the data of the questionnaire conducted the result shows the percentage of factors that effect the demand of Electric Vehicles .

**Financial Incentive (FI)**

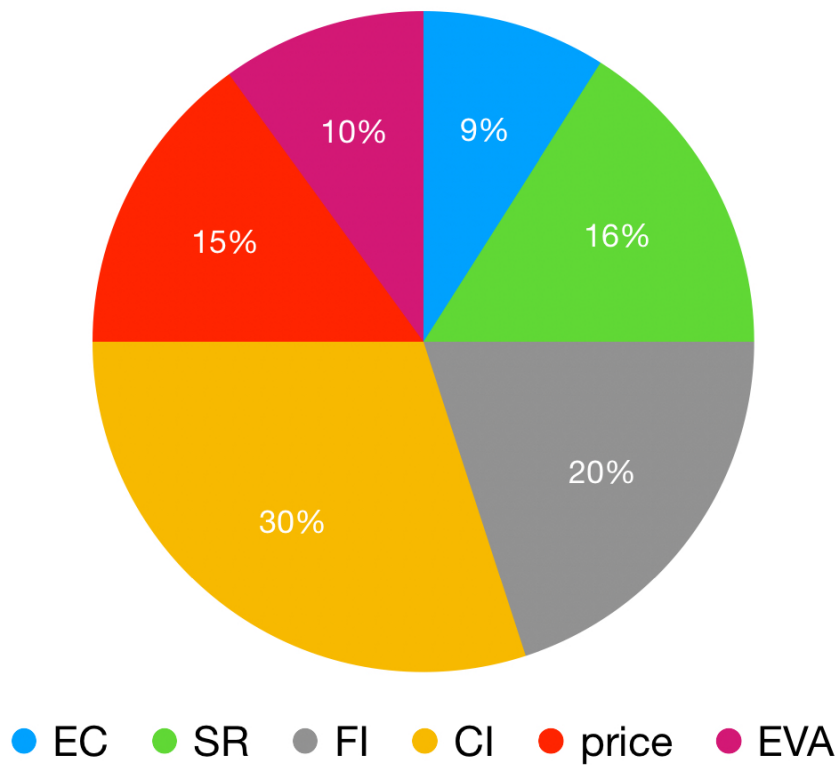
**Environment Concern (EC)**

**Social Reinforcement (SR)**

**Charging Infrastructure (CI)**

**Electric vehicle Adoption (EVA)**

**Price**



### Future scope

- Electric vehicles are tend to be the mainstream mode of transportation in future .
- According to a survey conducted in 2023 the yearly sale in India of Electric vehicles will be 10 million by the year 2030.
- There would be almost 10000 units of charging point in India by 2027 as the demand of EV's is increasing .
- Though it is also discovered that it might create Range anxiety amongst consumers.

## Conclusion

The future of Electric Vehicles will be fruitful. there will be more use of Electric Vehicles on the road as it will benefit in improving the quality of air and will be affordable than fuel car's. Driving would be easy and it is convenient as you can also charge the vehicle at your home though there are some limitations to it as well for example the charging time is more and limited driving range but the development is happening and government is installing recharging station everywhere.

The experience I gathered during my research was very fulfilling and rewarding I wish for others to get an opportunity like this in their professional life's.

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## Appendix

### Study

### Questionnaire

SN Questions Very Disagree Neutral Agree Disagree Strongly Concur With Financial Rewards

- 1) I'm happy with how public charging stations are now set up in India.  
Social Confirmation
- 2) Other people find it impressive that I drive an electric car.
- 3) My reputation in the community is enhanced by my electric car driving.
- 4) When I drive an electric car, I feel proud.
- 5) People consider me to be wealthy when I drive an electric car.
- 6) People think I'm a fashionista when I drive an electric car.  
Environmental Issue
- 7) I believe that the environment is better off with electric cars.
- 8) I'm really conscious about the environment.
- 9) I am well-versed in the government's electric car policy.
- 10) I agree with the financial rewards offered for purchasing electric cars.
- 11) The Indian government's financial incentives encourage the development of electric automobiles.
- 12) I believe it's simple to comprehend the government's financial incentives for electric vehicles.
- 13) The policies of the government lead me to believe that electric vehicles will be the norm in the future Infrastructure for Charging.
- 14) I have space and the ability to put a charging station in my house.
- 15) My workplace has car charging stations.
- 16) There are plenty of charging outlets in my area.
- 17) For things that are better for the environment, I am willing to spend extra.
- 18) Utilising electric cars can lessen pollution in the environment today.  
Cost
- 19) I am able to buy an electric car.
- 20) I believe that electric car prices are reasonable.
- 21) The cost of an electric vehicle is greater than that of a traditional car.  
Willing to Purchase or Adopt
- 22) I'd be prepared to purchase an electric car.
- 23) In the upcoming years, I intend to purchase an electric vehicle.
- 24) Compared to a regular automobile, I would rather own an electric vehicle.