"A Study on Role of Electric Vehicles on Reducing Pollution And Future Of Electric Vehicle In Indian Market"

A dissertation submitted to the School of Maritime Management, Indian Maritime University in the partial fullfillment of

Master of Business Administration

In

International Transportation and Logistics Management

By

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UNDER THE SUPERVISION AND GUIDANCE

OF

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(A Central University under the Ministry of Ports, Shipping and Waterways)

CHENNAI CAMPUS

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SCHOOL OF MARITIME MANAGEMENT
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Certificate

This is to certify that the project report titled **"A Study on Role of Electric Vehicles On Reducing Pollution And Future Of Electric Vehicle In Indian Market"** is a bonafide work done by **SURYA V (Reg.No: - 2103305040)** in partial fulfilment of the requirement for the award of the degree of Master of Business Administration in Indian Maritime University, Chennai.

External Viva- voice examination conducted on: -

External Examiner :-

Place : Chennai

Date :...../. ...../2023

DECLARATION

I, **SURYA V,** do hereby declare that the dissertation entitled **"A Study On Role Of Electric Vehicles On Reducing Pollution And Future Of Electric Vehicle In Indian Market"**is exclusively a bonafidework done by me under the supervision and guidance of **Dr. Emil Mathew**, Assistant Professor, School of Maritime Management and is submitted to Indian Maritime University inpartial fullfillment of the requirement for the award of the degree of Master of Business Administration.

I further declare that no part of this report has been previously submitted to any other university or academic body for the award of any degree or diploma.

Place : Chennai
Date :...../...../2023

SURYA V
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The dissertation entitled **"A Study On Role Of Electric Vehicles On Reducing Pollution And Future Of Electric Vehicle In Indian Market"** has been done under the supervision and guidance of Dr. **Emil Mathew**, Assistant Professor, School of Maritime Management, Indian Maritime

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With great pleasure I acknowledge the help given to me by my family members and my friends.

Place : Chennai **SURYA V**

Date :……/. **/2023** **(Reg No:210305040)**

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1.1. INTRODUCTION:

An electric vehicle (EV) is one that operates on an electric motor, instead of an internal-combustion engine that generates power by burning a mix of fuel and gases. Therefore, such as vehicle is seen as a possible replacement for current-generation automobile, in order to address the issue of rising pollution, global warming, depleting natural resources, etc. Though the concept of electric vehicles has been around for a long time, it has drawn a considerable amount of interest in the past decade amid a rising carbon footprint and other environmental impacts of fuel-based vehicles.

The first electric cars debuted in the middle of the 19th century. Up until about 1900, an electric car held the automobile land speed record. In comparison to Internal Combustion Engine Vehicles (ICEVs) of the 20th century, battery electric vehicles are more expensive, have a lower top speed, and have a shorter range, which has caused their use as private motor vehicles to fall globally. However, the usage of electric vehicles has persisted in the form of loading and freight machinery as well as public transportation, particularly rail vehicles. Beginning in 1828, numerous scientists and inventors made an effort to create electric motors, model vehicles, locomotives, etc. In April 1881, French inventor Gustave Trouvé tested the first human-carrying electric vehicle with its own power source down a street in Paris.The period between 1890 and 1900 is regarded as the "Golden Age" of the development of electric vehicles. Rich consumers who utilised them as city automobiles made electric cars popular. Currently in the twenty-first century, a number of businesses are beginning to manufacture electric vehicles on a huge scale. The lithium-ion batteries are one of the key technologies that made it possible for modern electric automobiles to go on public roads. Tesla Motors, Hitachi, Nissan, Mitsubishi, Renault Fluency Z.E, and General Motors are just a few of the pioneering businesses that have helped electric car technology evolve to where it is today.

The conventional internal combustion engines (ICEVs) now in use have drawbacks such unstable fuel prices, environmental harm, non-renewable energy waste, etc. The government wants India to be a 100% electric vehicle nation by 2030 in order to promote sustainable growth and cease dependence on oil. Given that domestic energy use makes up up to one-third of the total, this might have a significant impact on the

petroleum industry. In 2010, India made its first official move to encourage the use of electric vehicles. A Rs 95 crore programme authorised by the Ministry of New and Renewable Energy (MNRE) states thatA financial incentive for producers of electric vehicles marketed in India was offered by the government. The programme, which went into effect in November 2010, called for incentives of up to 20% on vehicle ex-factory pricing, subject to a maximum. The MNRE later withdrew the funding programme, though, in March 2012.

In order to undertake a significant transition to electric vehicles and to solve issues with national energy security, vehicle pollution, and the expansion of local manufacturing capabilities, India presented the "National Electric Mobility Mission Plan (NEMMP) 2020" in 2013. even though the plan was to essentially remained on paper, with the exception of offering subsidies and developing infrastructure for e-vehicles. Arun Jaitley, who was the finance minister at the time, pledged speedier adoption and production of electric cars (FAME), with an initial outlay of Rs 75 crore, during the presentation of the Union Budget for 2015–16 in Parliament. The programme was unveiled with the intention of providing incentives for clean-fuel technology automobiles in order to increase their sales to up to 7 million units by 2020. India announced its intention to switch to all-electric vehicles by 2030 in a declaration made by Transport Minister Nitin Gadkari in 2017.

The execution of such a plan, however, caused anxiety in the automotive sector. Later, the idea was scaled back from 100% to 30% by the administration. The Union Cabinet approved a Rs 10,000 crore initiative under the FAME-II scheme in February 2019. The implementation of this plan began on April 1, 2019. The scheme's principal goal is to hasten the adoption of electric and hybrid vehicles by providing upfront incentives for EV purchases and by setting up the necessary infrastructure for EV charging.

The primary technology for decarbonizing the road transport industry, which generates 16% of all emissions worldwide, is electric automobiles. The sale of electric vehicles has surged exponentially in recent years, along with their better range, expanded model selection, and improved performance. We predict that 13% of new cars sold in 2022 will be electric; assuming the growth seen over the past two years is sustained, CO2 emissions from cars can be put on a path consistent with the Net Zero Emissions by 2050 Scenario. Passenger electric cars are rapidly gaining popularity. Electric vehicles

are not, however, a universal phenomena yet. Due to increased purchasing costs and a lack of charging infrastructure, sales have lagged in developing and growing nations.

Despite supply chain snags and the ongoing Covid-19 epidemic, electric car sales hit a new high in 2021. Sales increased by over double to 6.6 million, or roughly 9% of total sales, from 2020 to 2021, increasing the total number of electric vehicles on the road to 16.5 million. In 2021, the sales share of electric vehicles rose by 4 percentage points. According to the Net Zero Emissions by 2050 Scenario, there will be more than 300 million electric vehicles on the road by 2030, and they will make up 60% of all new car sales. Their sales share must rise by less than 6% percentage points annually to be on track with the Net Zero Scenario.

1.2. SIGNIFICANCE TO THE INDIAN ECONOMY:

Electric vehicles will rule the market by 2030 due to its environmental friendliness, usage of renewable energy, and cost-effective fuel. Therefore, there is a good likelihood that EVs will eventually replace traditional ICEVs. Electric vehicles can significantly contribute to the global effort to prevent climate change by assisting in the reduction of emissions and reliance on fossil fuels. As a result, India's adoption of electric vehicles is essential for the fight against global warming.Although battery and automotive technology is constantly developing, it has a bright future and has the potential to meet a sizable portion of the market's demand.

India, a developing nation, would likely give up on domestic fuel usage in an effort to adapt to these technological improvements. The cost of petrol has been rising in recent years. India currently depends 82.8% on imported crude oil. The transition of home energy consumption to electricity may have a significant impact on these circumstances. Since EVs are thought to be the wave of the future, the Indian Petroleum Market may experience significant changes as a result. Fossil fuels like natural gas and petroleum have been extensively employed since the introduction of the vehicle in 1886, spawning a spectacular industry. Now that electric vehicles are starting to replace ICEVs, the acquisition and sale of fossil fuels may undergo a significant transformation.By 2030, the Indian government wants to have an entirely electric vehicle fleet, which will increase the market for electric vehicles. With the proper study, its environmental effects and fuel efficiency can be maximised and promoted in place of ICEVs.

1.3. CURRENT STATUS OF E VEHICLES:

According to Mr. Nitin Gadkari, Minister of Road Transport and Highways and MSMEs, the country's electric vehicle (EV) market gained 163% in 2021 compared to the previous year, with 324,840 EVs registered. In 2021, there were 324,840 registered EVs, which represented 1.7% of the 18,312,760 petrol and diesel vehicle registrations.

Between 2019-2020 and 2020-2021:

➢ Sales of two-wheeler electric cars increased by 422%, from 28,508 to 149,068

➢ Three-wheeler electric vehicle sales increased by 75%, from 90,216 to 157,682

➢ Four-wheeler electric vehicle sales increased by 230%, from 4,695 to 15,860

Uttar Pradesh sold the most electric vehicles in 2021, with 66,702, followed by Karnataka with 33,307, Tamil Nadu with 30,037, Maharashtra with 29,860, and Delhi with 25,809.

To support EVs, the government is doing the following:

- The Faster Use and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) Scheme was introduced by the government in 2015 on a pan-India basis in an effort to accelerate the production and uptake of EVs in India.
- Phase-II of the FAME India Scheme, which will help with the electrification of public and shared transport, is currently being implemented for a period of five years, starting on April 1, 2019, with a budgetary support of Rs. 10,000 crore (US$ 1.32 billion).
- Under this scheme, incentives are provided to buyers of EVs in the form of an upfront reduction in the purchase price of the vehicle.

1.5. OBJECTIVES:

- To understand the demand pattern of E-Vehicles.
- To propose suggestions to government to promote the use of EV among the people.
- To study the environmental impacts of electric vehicles.

1.6. METHODOLOGY:

The study is based on both Primary data and Secondary data.

- The primary data is collected from a well-structured questionnaire issued to respondents selected from various people in Chennai city. The data collected is represented in the form of Frequency distribution, Percentage Analysis, Bar diagrams, Pie Diagrams and Graphs and Charts.
- The Secondary Data is collected from Journals, Books, Magazines, websites, etc.
- The Sample size of the study is 100 respondents.

1.7. HYPOTHESIS:

- **H0 –** There is no significant difference between the monthly income and affordability of electric vehicles for the people.
- **H1 –** There is significant difference between the monthly income and affordability of electric vehicles for the people.

1.8. LIMITATIONS:

1. The time period of the research is limited.
2. The survey is confined to Chennai city.
3. Conflicts arising from cultural bias and other personal issues.

1.9. CHAPTERISATION:

1. Chapter I deals with Introduction, Objectives, Methodology and Limitations.
2. Chapter II deals with Review of Literature.
3. Chapter III deals with the Implementation of Electric Vehicles.
4. Chapter IV deals with Data Analysis.
5. Chapter V deals with Findings, Suggestions and Conclusion.

CHAPTER - II

CHAPTER - II

REVIEW OF LITERATURE:

INTRODUCTION:

Review of literature familiarizes the researcher with concepts and conclusions already evolved by earlier studies. It also enables the present researcher to find out the scope for further study and to frame appropriate objectives for the proposed evaluation. Since the proposed study is to analyse the execution of E-Vehicles, benefits of the usage of E-Vehicles, the previous studies made in this area are briefly reviewed in this chapter. Further the opinions expressed by various authors in leading articles, journals and books are also discussed.

STUDIES PERTAINING INTO REGIONAL LEVEL:

Serra (2011) published a book with the title "Electric vehicles: Technology, Policy and Commercial Development". The book sets out the commercial and political barriers to their increased use and lays out the ways in which these barriers can be overcome. He examined the key issue of energy storage and recharging infrastructure. The book covers industrialised and emerging economy contexts to take the EV development route.

Thomas (2012) examined that how environment friendly are e-vehicles. He evaluated the maximum potential of EVs to cut GHG emissions and oil consumption in the U.S. and compared them with the GHG and oil reduction potential of hydrogen-powered fuel cell electric vehicles. Battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs) are often labelled "green", implying that they will significantly reduce greenhouse gas (GHG) emissions.

STUDIES PERTAINING TO NATIONAL LEVEL:

Situ (2009) assessed the past, present, and future possibilities of various types of electric vehicles and their road towards gaining public acceptance while taking into account variables such as technological advancements, alternatives to fuel vehicles that release particles, renewable energy sources, etc. One of the topics the article focused on

is how rapidly changing technology affects governmental policies. It evaluated the potential for technological advancement of electric vehicles in comparison to rivals like fuel cells, plug-in hybrids, plug-in electric vehicles, and biofuels.

Hannana, Azidinab, et.al., (2013) wrote a paper on the hybrid electric vehicles and their challenges. The study offers a thorough analysis of hybrid electric vehicles, including information on the models, energy management systems (EMS), and source combinations created by different researchers. According to the thorough analysis, the current technologies can execute HEVs reasonably effectively, but their dependability and intelligent systems are still not up to par. As a result, various elements, difficulties, and issues related to the sustainability of next-generation hybrid vehicles have been highlighted in their research.

STUDIES PERTAINING TO INTERNATIONAL LEVEL:

Ahman (2004) carried out a thorough analysis of the Japanese government's initiatives to put policies in place and conduct research on the most recent technology of electric vehicles. Their conclusions were that flexibility, adaptability, and cooperation in terms of technical choice are necessary in policy, leading to competitive technology. It concentrates on BPEVs (Battery Powered Electric Vehicles) and examined the development of the technology in Japan, as well as the government's policies and scientific research that contributed to their advancement.

Wang, Kimble (2011) performed a study on how China is catching up to the world in terms of electric vehicle technology, given that the country currently dominated the global market for car manufacturing and sales. They analysed the variables influencing the patterns they identify as four major ones in this leapfrogging. They concluded by presenting some empirical data on the variables that might affect China's capacity to advance to electric vehicles and three possible scenarios for China's actual advancement.

CHAPTER - III

CHAPTER - III

PROFILE OF THE STUDY

3.1. ELECTRIC VEHICLES:

An electric motor powers an electric vehicle (EV) as opposed to an internal combustion engine, which produces power by burning a mixture of fuel and gases. Therefore, in order to solve issues such as increased pollution, global warming, the depletion of natural resources, etc., such a vehicle is considered as a potential substitute for current-generation automobiles. Even though the idea of electric cars has been around for a while, it has attracted a lot of attention in the last ten years due to the growing carbon footprint and other environmental effects of fuel-powered cars.

Midway through the 19th century, electric vehicles made their debut. The land speed record for vehicles was held by an electric vehicle until about 1900. Battery electric vehicle use as private motor vehicles has decreased significantly across the globe due to their high price, slow peak speed, and limited range as compared to Internal Combustion Engine Vehicles (ICEVs) from the 20th century. However, the usage of electric vehicles in loading, freight, and public transportation, particularly rail vehicles, has continued. Electric motors, model cars, locomotives, and other inventions have all been attempted since 1828 by various scientists and inventors.

Currently in the twenty-first century, a number of businesses are beginning to manufacture electric vehicles on a huge scale. The lithium-ion batteries are one of the key technologies that made it possible for modern electric automobiles to go on public roads. Tesla Motors, Hitachi, Nissan, Mitsubishi, Renault Fluency Z.E, and General Motors are just a few of the pioneering businesses that have helped electric car technology evolve to where it is today.

The first formal decision to encourage the use of electric vehicles in India was made The Ministry of New and Renewable Energy (MNRE) authorised a Rs 95 crore programme, and the government offered a financial incentive for makers of electric vehicles sold in India. The programme, which went into effect in November 2010,

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- Phase-II of the FAME India Scheme is currently being implemented for a period of five years, beginning on April 1, 2019, with a budgetary support of Rs. 10,000 crore (US$ 1.32 billion), which will focus on assisting with the electrification of public and shared transportation.

- The government approved a PLI scheme for Advanced Chemistry Cell (ACC) manufacturing on May 12, 2021, in order to lower battery prices in the country.

- It has also exempted battery operated transport vehicles from having to obtain a permit, from the payment of fees for the purpose of issue or renewal registration certificate and assignment of new registration mark.

3.4. E-VEHICLES AND ITS TYPES:

An electric motor powers an electric vehicle (EV) as opposed to an internal combustion engine, which produces power by burning a mixture of fuel and gases. Therefore, in order to solve issues such as increased pollution, global warming, the depletion of natural resources, etc., such a vehicle is considered as a potential substitute for current-generation automobiles. Even though the idea of electric cars has been around for a while, it has attracted a lot of attention in the last ten years due to the growing carbon footprint and other environmental effects of fuel-powered cars.

There are four main types of electric vehicles (EV).

- **Battery Electric Vehicles (BEV)**
- **Plug-in Hybrid Electric Vehicles (PHEV):**
- **Hybrid Electric Vehicle (HEV):**
- **Fuel Cell Electric Vehicle (FCEV):**

3.4.1. Battery Electric Vehicles (BEV)

Compared to an internal combustion engine, battery powered electric vehicles have approximately 99% fewer moving parts that need maintenance.

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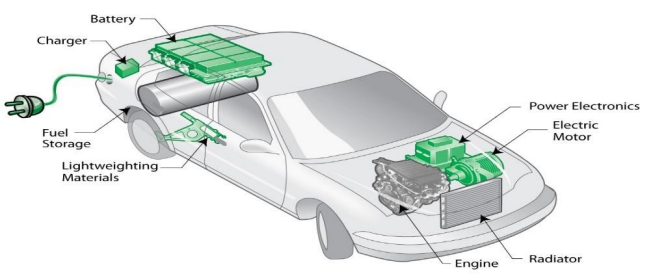
Advantages of a BEV:

- Creates very little noise
- No exhaust, spark plugs, clutch or gears
- Doesn't burn fossil fuels, instead uses rechargeable batteries

BEVs may be charged overnight at home, giving them enough range for routine commutes. Although regenerative braking or travelling downhill can help reduce this by charging the battery packs, longer or more difficult trips may need charging the fuel cells before you arrive at your destination. An electric automobile can take anywhere from 30 minutes to more than 12 hours to fully charge.The size of the battery and the charging station's speed are both important factors. A pure electric vehicle (PEV) is

FIGURE 3.14



another name for a battery electric vehicle (BEV). It is a particular kind of electric vehicle (EV) that has no additional power source and exclusively uses chemical energy stored in rechargeable battery packs.

3.4.2. Plug-in Hybrid Electric Vehicles (PHEV):

PHEVs are extensions of conventional hybrid vehicles. They have both an internal combustion engine and an electric motor that is powered by batteries. This lowers your need for petrol by up to 60% and enables the battery to store enough energy to operate the electric motor. Hybrid electric vehicles provide a combination of battery and petrol (or diesel) power rather than just depending on an electric motor. They are therefore superior for long-distance travel because you can switch to conventional fuels rather than looking for charging stations to top off the battery. Of course, PHEVs share the same drawbacks as combustion engine vehicles, such as the need for greater maintenance, increased engine noise, pollutants, and increased fuel costs. PHEV salso have smaller battery packs, which means a reduced range.

3.4.3. Hybrid Electric Vehicle (HEV):

HEVs are operated by both an internal combustion engine and an electric motor that draws energy from a battery. However, unlike other electric vehicles, HEV drivers charge their batteries through regenerative braking.

3.5.4. Fuel Cell Electric Vehicle (FCEV):

FCEVs have many of the same components as BEVs, such as electric motors and power controllers or inverters; however, the primary energy source is different. While BEVs use battery energy, FCEVs utilize fuel cells, which are better than batteries in many aspects.

3.5. COMPONENTS OF ELECTRIC VEHICLES:

Electric vehicles are equipped with an electric motor and a battery pack. The primary advantage of electric cars is that they create no pollutants and are environmentally beneficial. They also do not utilize any fossil fuels; therefore, the automobile is powered by a sustainable source of energy. The following are the primary components of electric vehicles:

- **Charge Port:** The charging port links the electric car to a power source from outside. It powers up the battery pack. The charging port is sometimes positioned in the vehicle's front or back.

- **DC-DC Converter:** The traction battery pack provides a steady voltage. However, the specifications for various vehicle complex movement. The DC-DC converter transfers the output power from the battery to the desired level.

- **Auxiliary batteries:**Auxiliary batteries provide electrical energy to electric car accessories. In the event that the primary battery fails, the auxiliary batteries will continue to charge the vehicle.

- **Traction battery pack:** Electric vehicle battery (EVB) is another name for traction battery pack. It provides electricity to an electric vehicle's motors. The battery serves as a power storage system. It stores energy in the form of direct current (DC current).

- **Transmission:** It transfers mechanical power from the electric motor to the wheels through a gearbox. Electric vehicles have the benefit of not requiring multi-speed gearboxes. To minimize power loss, transmission efficiency should be good.

- **Electric motor:** The essential component of an electric vehicle is the electric traction motor. The wheels are rotated by this energy. The major component that distinguishes an electric automobile from a normal car is its electric motor.

- **Thermal system (cooling):** The thermal management system is in charge of keeping the key components of an electric vehicle, such as the electric motor and controller, at a constant working temperature. It also works while charging to provide optimal performance. It employs a mix of thermoelectric, forced air, and liquid cooling.

- **Power inverter:** It converts DC power from the batteries to alternating current electricity. It also transforms the alternating current generated by regenerative braking into a direct current. This is also used to charge the batteries.

- **Controller:** The operation of an electric vehicle is determined by the power electronics controller. It regulates the flow of electrical energy from batteries to electric motors. The driver's pedal affects the car's speed and the frequency of voltage fluctuation input to the motor.

3.6. ADVANTAGES OF ELECTRIC VEHICLES:

Environmentally friendly: Since electric vehicles don't burn fuel, there are no emissions or petrol exhaust. Driving an electric car can help contribute to a cleaner environment because fossil fuel-powered vehicles considerably contribute to the buildup of dangerous gases in the atmosphere.

Renewable energy source: Electric vehicles are powered by renewable energy, as opposed to traditional cars, which use fossil fuels, depleting the world's reserves of such resources.

Smoother motion and less noise: Driving an electric automobile is much more comfortable. They are quieter and make less noise because they don't contain any fast-moving components.

Cost-effective: Compared to fuels like petrol and diesel, which frequently experience price spikes, electricity is significantly less expensive. Battery recharge is affordable when solar electricity is used at home.

Low maintenance: Compared to typical vehicle parts, wear and tear is decreased with electric cars since there are less moving parts. Compared to combustion engines, repairs are also less complicated and expensive.

Government support: Government assistance As part of a green initiative, governments all over the world have provided tax benefits to entice people to use electric vehicles.

3.7. DISADVANTAGES OF ELECTRIC VEHICLES:

High initial cost: The cost of electric vehicles continues to be high, and many purchasers think they are not as affordable as conventional cars.

Limitations of charging stations: Long-distance travellers worry about accessing adequate charging stations, which are not always available, in the middle of their trip.

Recharging takes time: Unlike conventional cars, which can fill up their petrol tanks in only a few minutes, charging an electric car takes several hours.

Fewer options There aren't many electric car models available right now that you may choose from in terms of design, style, or personalised variants.

Less driving range: When compared to conventional automobiles, electric vehicles have a shorter driving range. Electric cars can be convenient for short-distance travel but are inconvenient for long-distance travel.

3.8. VEHICULAR EMISSIONS

According to whether they are indirect byproducts of gaseous reactions in the environment or direct "tailpipe" emissions created by gasoline burning in conventional automobiles, vehicle emissions can be classified. Below, we list both types:

Carbon-dioxide

One of the main components of a car's tailpipe emissions is carbon dioxide (CO2). Currently, motor vehicles are projected to contribute up to 24% of the world's direct CO2 emissions, which are an end result of any fuel burning process. Even while they might not offer any immediate health risks, their accumulation causes more global heat and intensifies climate change.

Carbon-monoxide

A very poisonous, colourless, and odourless gas called carbon monoxide (CO) is produced when fossil fuels burn partially. This is highly detrimental to health as it affects the body’s ability to absorb oxygen. Studies have found that in highly polluted cities like New Delhi, vehicular emissions are the primary source of CO, which most notably fell by nearly 86 per cent during the Covid-19 lockdown due to restrictions on vehicular movement.

Nitrous-oxide

Nitrous oxide (NOx) arises from the high-temperature combustion of fossil fuels and further contributes to ozone generation. Indian cities like New Delhi, Bangalore, Mumbai, and Kolkata have some of the highest sources of NOx in the country – linked exclusively to vehicular pollution8. An excess amount of NOx gives rise to ground-level ozone. Although not directly emitted from transport, this deadly secondary gas is highly correlated with respiratory diseases and asthma upon creation.

Particulate-matter

Particulate matter (PM) are combinations of solid and liquid pollutants such as dust, soot, smoke that are easily inhalable. These are categorised as PM 2.5 or PM 10, depending on their diameter. These could be directly formed as a result of fuel combustion or could be an indirect consequence of complex atmospheric reactions. The transport sector contributes to a third of India's PM pollution and 20-35 per cent of PM 2.5 pollution in urban Indian cities.

3.9. COMPARISON TABLE OF PROS AND CONS OF ELECTRIC VEHICLES:

Table 3.1

Pros	**Cons**
Electric cars are powered by batteries; thus, theyemit no emissions, which helps to keep pollution under control in theenvironment.	Electric vehicles have a high initial purchase cost, and many consumers cannot afford them in their budgets, thus they are hesitant to move from regular vehicles to electric vehicles.
Although electric cars rely on renewable energy, they assist to protect non-renewable energy supplies, which are fast depleting owing to broad use.	Due to the lack of electric car models accessible to the market, buyers have few alternatives in terms of design, appearance, or customized variants.

The moving components in electric vehicles are less numerous than those in traditional automobiles, which means they last longer. Repairing EVs is also less expensive than regular automobiles.	People who travel long distances are concerned about becoming stuck because there are fewer charging outlets accessible.
Driving an electric car is significantly smoother and quieter since there are no fast-moving	The charging time of an electric car is around four to six hours.
Governments all across the globe have provided taxbreaks to encourage people to buy electric vehicles.	The electric vehicle gets less mileage thangasoline-powered vehicles and is only

COST OF FEW ELECTRIC VEHICLES:

Table 3.2 Electric bike

S.NO	BRAND	COST
1	Vida V1	Rs 1.28 – 1.39 Lakh
2	Ather 450X	Rs 1.37 – 1.60 Lakh
3	Ola S1	Rs.84,999 - 1.33 Lakh
4	TVS iQube Electric	Rs.1.61 - 1.61 Lakh
5	Revolt RV400	Rs.1.25 Lakh
6	Simple One	Rs.1.10 - 1.45 Lakh
7	Bajaj Chetak	Rs.1.52 Lakh
8	Hero Electric Optima	Rs.67,190 - 85,190
9	Hero Electric NYX	Rs73,590 - 86,540
10	Birla XL	Rs1.52 Lakh

TABLE 3.3 Electric cars

S.NO	**BRAND**	**COST**
1	Tata Tiago EV	Rs. 8.49 Lakh
2	Mahindra E Verito	Rs. 9.12 Lakh
3	Tata Tigor EV	Rs. 12.49 Lakh

4	Tata Nexon EV Prime	Rs. 14.49 Lakh
5	Mahindra XUV400 EV	Rs. 15.99 Lakh
6	Bmw i4	Rs. 69.90 Lakh
7	Mercedes-Benz EQB	Rs. 74.50 Lakh
8	Kia EV6	Rs. 60.95 Lakh
9	MG ZS EV	Rs. 22.98 Lakh
10	Hyundai Kona Electric	Rs. 23.84 Lakh

3.19. CURRENT STATUS OF E VEHICLES:

According to Mr. Nitin Gadkari, Minister of Road Transport and Highways and MSMEs, the country's electric vehicle (EV) market gained 163% in 2021 compared to the previous year, with 324,840 EVs registered. In 2021, there were 324,840 registered EVs, which represented 1.7% of the 18,312,760 petrol and diesel vehicle registrations.

Between 2019-2020 and 2020-2021:

➢Sales of two-wheeler electric cars increased by 422%, from 28,508 to 149,068

➢Three-wheeler electric vehicle sales increased by 75%, from 90,216 to 157,682

➢Four-wheeler electric vehicle sales increased by 230%, from 4,695 to 15,860

Uttar Pradesh sold the most electric vehicles in 2021, with 66,702, followed by Karnataka with 33,307, Tamil Nadu with 30,037, Maharashtra with 29,860, and Delhi with 25,809.

The government is taking the following steps to promote EVs:

❖The government launched the Faster Use and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) Scheme in 2015 on a pan-India basis in order to boost the manufacturing and adoption of EVs in India.

❖Phase-II of the FAME India Scheme is currently being implemented for a period of five years, beginning on April 1, 2019, with a budgetary support of Rs. 10,000 crore (US$ 1.32 billion), which will focus on assisting with the electrification of public and shared transportation.

❖Under this scheme, incentives are provided to buyers of EVs in the form of an upfront reduction in the purchase price of the vehicle.

❖Under the PLI Scheme for Automobiles and Auto Components, battery electric vehicles are also eligible for incentives.

❖The government approved a PLI scheme for Advanced Chemistry Cell (ACC) manufacturing on May 12, 2021, in order to lower battery prices in the country.

❖It has also exempted battery operated transport vehicles from having to obtain a permit, from the payment of fees for the purpose of issue or renewal registration certificate and assignment of new registration mark.

3.7. ELECTRIC VEHICLE FUTURE IN INDIA AND THE WORLD – A BRIEF STATISTICAL LOOK:

- Global EV marketing is growing at a staggering CAGR of 21.7%. A whopping 4.19 lakh EVs have already been sold in India in 2022. This number stood at a mere 1.19 lakhs in 2020.
- Studies predict a sale of 39.21 million EV units by the year 2021.

4 Reasons Why the Future of Electric Vehicles in India is Bright:

1. Reduced CO2 Emissions and Sustainability

2. Cheaper to Buy and Drive

3. Charging Made Easy

4. Enjoyable Driving Experience

The Road Ahead

3.8. INTRODUCTION TO ELECTRIC VEHICLE POLICY TAMILNADU

Worldwide, nations are progressively lowering their reliance on fossil fuels with the goal of switching to the use of electric vehicles in the next years. Tamil Nadu's government, like many others in India, is moving in the right way and has passed the Tamil Nadu Electric Vehicle Policy (2019). Let's now examine theories concerning Tamil Nadu's electric vehicle subsidies as well as the state's charging infrastructure regulations and incentives.

3.8.1. HIGHLIGHTS OF TAMIL NADU EV POLICY:

The Tamil Nadu EV Policy was developed to bring in Rs. 50,000 Crores as seed money for the state's electric vehicle manufacturing industry and to foster a more favourable environment for it. The goal of the strategy is to advance electric vehicle research and development, guarantee the development of a trained labour force, create new opportunities, and make Tamil Nadu the preferred location for electric car and component manufacturers. In addition, the policy takes sustainability into consideration and tries to ensure that the principles of "reuse" and "recycle" are upheld, as well as that any rejected batteries are disposed of sustainably.

Demand-side Incentives for Electric Vehicles

The Tamil Nadu EV policy makes provisions for the following incentives:

- On the purchase of electric two-wheelers, road taxes and registration charges will be waived up until the end of 2022.
- On the purchase of electric three-seater rickshaws, permit fees, road taxes, and registration charges will be waived up until the end of 2022.
- On the purchase of electric transport vehicles (taxis and tourist cars), permit fees, road taxes, and registration charges will be waived up until the end of 2022. In addition, state transport units can also avail subsidies when purchasing electric buses.
- On the purchase of electric light goods carriers. Additionally, road taxes and registration charges will be waived up until the end of 2022.
- On the purchase of electric cars (private), road taxes and registration charges will be waived until the end of 2022.
- **Subsidy for Electric Two-wheelers**
  Under the Tamil Nadu EV policy, the following subsidy is applicable on two-wheelers:

- Up until the 30th of December 2022, you can avail of a 100% exemption on road tax on electric two-wheelers.
- If you purchase an electric two-wheeler, registration charges for your vehicle will be waived by the Tamil Nadu government.

Subsidy for Electric Cars and SUVs

Under the Tamil Nadu EV policy, the following subsidy is applicable on electric cars and SUVs:

- Until the 30th of December 2022, you can avail of 50% - 100% exemption on road tax on electric cars.
- If you purchase an electric car, registration charges for your vehicle will be waived by the Tamil Nadu government.

Charging Infrastructure Incentives

• The state government will assist in funding and establishing charging stations in collaboration with the public and commercial sectors, as well as TANGEDCO.

• Attractive capital subsidy programmes will be made available to private players in order to install charging stations.

• Charging stations will be installed in a variety of commercial buildings, including theatres, malls, condominiums, and hotels.

• In Chennai, Trichy, Salem, Madurai, Tirunelveli, and Coimbatore, the Tamil Nadu government will set up 3*3 grid charging stations.

• Along the state and national highways that pass Tamil Nadu, charging stations will be installed every 25 kilometres.

- Charging stations will be available in the parking lots of government buildings in Chennai, Trichy, Salem, Madurai, Tirunelveli, and Coimbatore.

3.24. DEMAND PATTERN OF E VEHICLES STATE WISE:

13, 34, 385 electric vehicles and 27, 81, 69,631 non-electric vehicles are now in use in India. Below is a full list of electric cars and all vehicles on Indian roads, broken down by state or union territory, taken from the e-varan portal run by the Ministry of Road Transport and Highways. The number of electric vehicles currently being utilised in India, broken down by state, as of July 14, 2022

Table 3.4

S.NO	STATE NAME	TOTAL ELECTRIC VEHICLE	TOTAL NON-ELECTRIC VEHICLE	TOTAL
1	Andaman & Nicobar Island	162	1,46,945	1,47,107
2	Arunachal Pradesh	20	2,52,965	2,52,985
3	Assam	64,766	46,77,053	47,41,819
4	Bihar	83,335	1,04,07,078	1,04,90,413
5	Chandigarh	2,812	7,46,881	7,49,693
6	Chhattisgarh	20,966	68,36,200	68,57,166
7	Delhi	1,56,393	76,85,600	78,41,993
8	Goa	3,870	10,71,570	10,75,440
9	Gujarat	45,272	2,06,05,484	2,06,50,756
10	Haryana	37,035	1,07,78,270	1,08,15,305
11	Himachal Pradesh	1,175	19,64,754	19,65,929
12	Jammu and Kashmir	2,941	18,69,962	18,72,903
13	Jharkhand	16,811	64,86,937	65,03,748
14	Karnataka	1,20,532	2,68,70,303	2,69,90,835
15	Kerala	30,775	1,57,74,078	1,58,04,853
16	Ladakh	26	38,302	38,328
17	Maharashtra	1,16,646	3,10,58,990	3,11,75,636
18	Manipur	586	4,99,324	4,99,910
19	Meghalaya	49	4,59,001	4,59,050
20	Mizoram	21	3,15,626	3,15,647
21	Nagaland	58	3,39,129	3,39,187

22	Odisha	23,371	98,45,073	98,68,444
23	Puducherry	2149	1213735	1215884
24	Punjab	14804	1,24,63,019	1,24,77,823
25	Rajasthan	81338	1,73,27,388	1,74,08,726
26	Sikkim	21	97,189	97,210
27	Tamil Nadu	82,051	2,98,42,376	2,99,24,427
28	Tripura	9,262	6,50,026	6,59,288
29	UT of DNH and DD	183	3,07,671	3,07,854
30	Uttarakhand	31,008	33,12,041	33,43,049
31	Uttar Pradesh	3,37,180	4,00,92,490	4,04,29,670
32	West Bengal	48,767	1,41,34,171	1,41,82,938
	GrandTotal	13,34,385	27,81,69,631	27,95,04,016

Source: Press Information Bureau, Delhi.

3.25. INDIA'S ELECTRIC VEHICLE SALES AS ON APRIL 2022

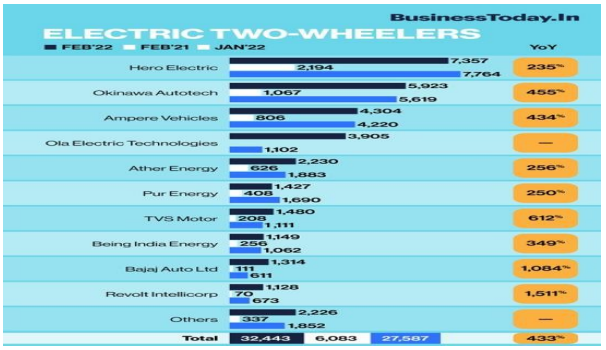


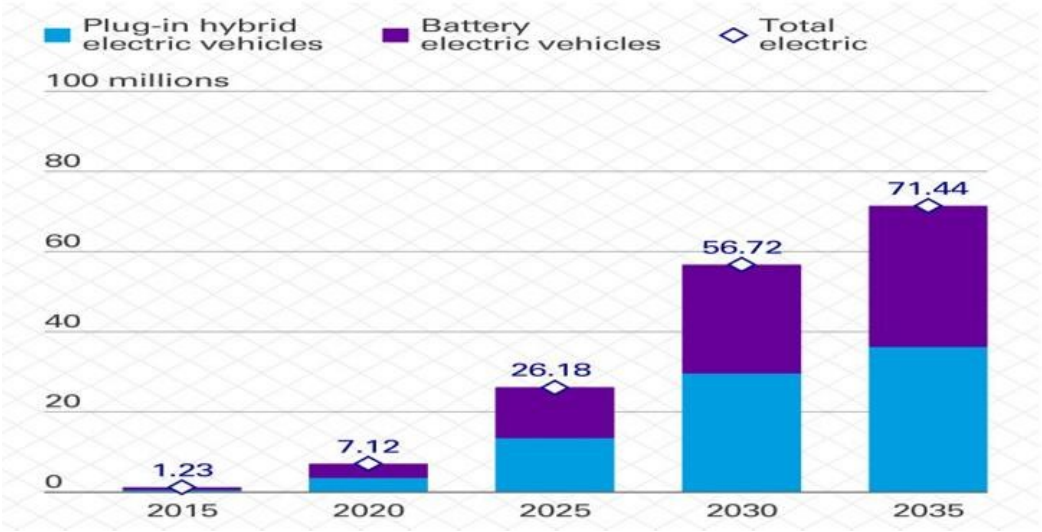
FIGURE 3.22 Source: Federation of Automobile Dealers Association

3.26. PETROL AND DIESEL USE IS DESTROYING OUR PLANET

Fossil fuels are scarce and their consumption is endangering the environment. The public's health is negatively impacted over the long term by toxic emissions from petrol and diesel vehicles. Compared to petrol or diesel vehicles, electric vehicles have significantly lower emissions. From an efficiency standpoint, petrol or diesel vehicles can only transfer 17%–21% of the energy contained in the fuel to the wheels, whereas electric vehicles can convert about 60% of the electrical energy from the grid to power

the wheels.That represents an 80 percent waste. Even when power production is taken into account, petrol or diesel vehicles still release approximately three times as much carbon dioxide as the average EV. Fully electric vehicles have zero tailpipe emissions. India aims to attain roughly 40% of its installed electric power capacity from non-fossil fuel-based energy sources by the year 2030 in order to lessen the impact of charging electric vehicles. Electric vehicles are the future of mobility in India, thus we must make the transition right away.

FIGURE 3.24



Source: Energy Outlook

3.27. CONCLUSION:

Although electric vehicle manufacturers must solve the hurdles that are currently preventing people from purchasing, the future is clear: EVs will outlast gas-powered automobiles in the long run. Both GM and Nissan declared in January 2021 that they will go all-electric by the 2030s. Other automakers will undoubtedly follow suit.

CHAPTER - IV

CHAPTER – IV

DATA ANALYSIS & INTERPRETATION

Chapter 4 of the research project, which focuses on data interpretation and analysis pertaining to the electric vehicle (EV) market. In this chapter, we delve into the wealth of information available and extract meaningful insights to shed light on the current state and future prospects of electric vehicles.This chapter deals with the detailed data analysis and interpretation of data which I got from the respondents of the QUESTIONNAIRE.

GENDER

Table 4.1

GENDER	FREQUENCY	PERCENTAGE
Male	40	40
Female	60	60
Prefer not to say	0	0
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

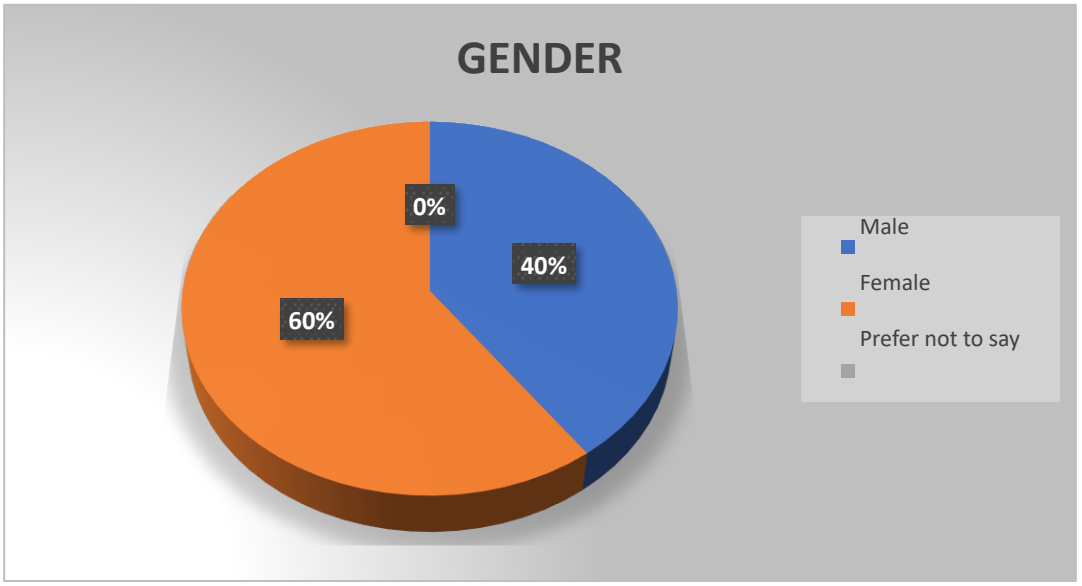


CHART 4.1

INTERPRETATION:

From the above table 4.1, it can be inferred that the number of female members is more than the male members. Out of the 100 respondents, 60 are female members which signifies that electric vehicles are more preferred by females than male members.

AGE GROUP

TABEL 4.2

AGE GROUP	FREQUENCY	PERCENTAGE
20-30	91	91
30-40	7	7
40-50	0	0
Above 50	2	2
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

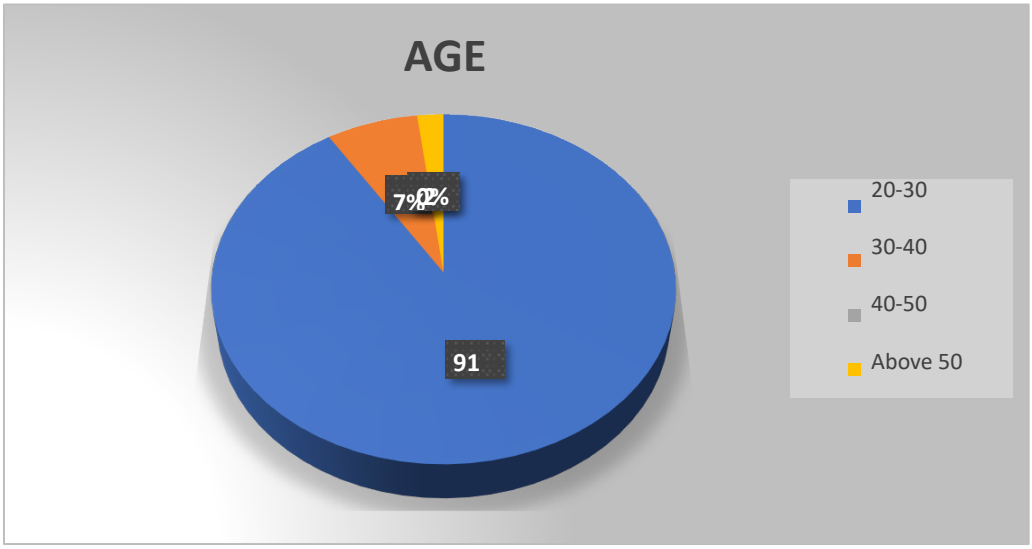


CHART 4.2

INTERPRETATION:

The above table 4.2 shows that people from the age group of 20-30 years are more aware of electric vehicles in the present scenario. Almost 90 percent of the people are from 20-30 age group. People from the age group of 30-40 are also aware of electric vehicles but are comparatively less than the people from the age group of 20-30.

MONTHLY INCOME

TABEL 4.3

MONTHLY INCOME	FREQUENCY	PERCENTAGE
15,000-25,000	30	30
25,000-50,000	13	13
50,000-1,00,000	36	36
Above 1,00,000	13	13
Nil	8	8
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

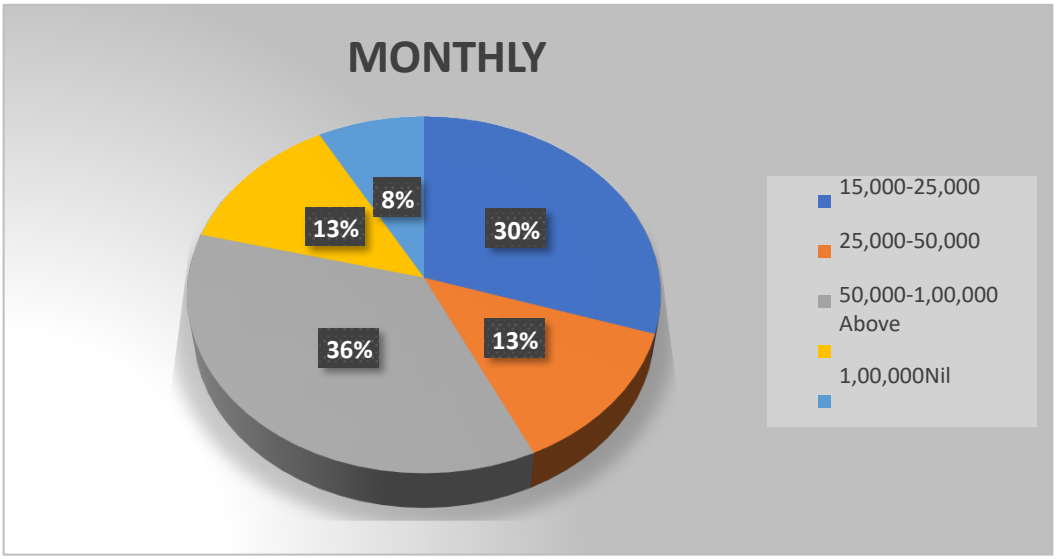


CHART 4.3

INTERPRETATION:

From the above table 4.3, we can infer that 36 percent of the people earn 50,000-1,00,000 as their monthly income. Hence, among the 100 respondents almost 49 members can afford to buyan electric vehicle.

ELECTRIC VEHICLE

TABLE 4.4

ELECTRIC VEHICLE	FREQUENCY	PERCENTAGE
Yes	54	54
No	46	46
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

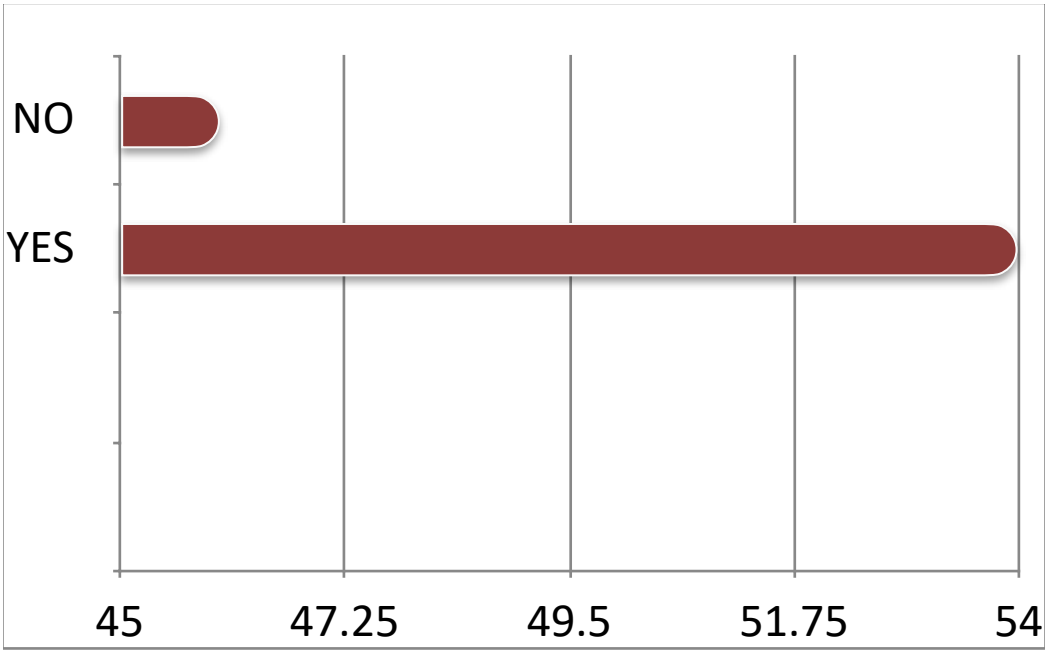


CHART 4.4

INTERPRETATION:

Among the 100 respondents, 54 percent of the people own an electric vehicle whereas 46 percent of the people do not own an electric vehicle. Therefore, it can be found that the demand for electric vehicles is increasing among the people and many started using E-Vehicles as their mode of transportation.

AWARENESS OF THE INCREASE IN DEMAND

TABLE 4.5

AWARENESS	FREQUENCY	PERCENTAGE
Yes	94	94
No	6	6
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

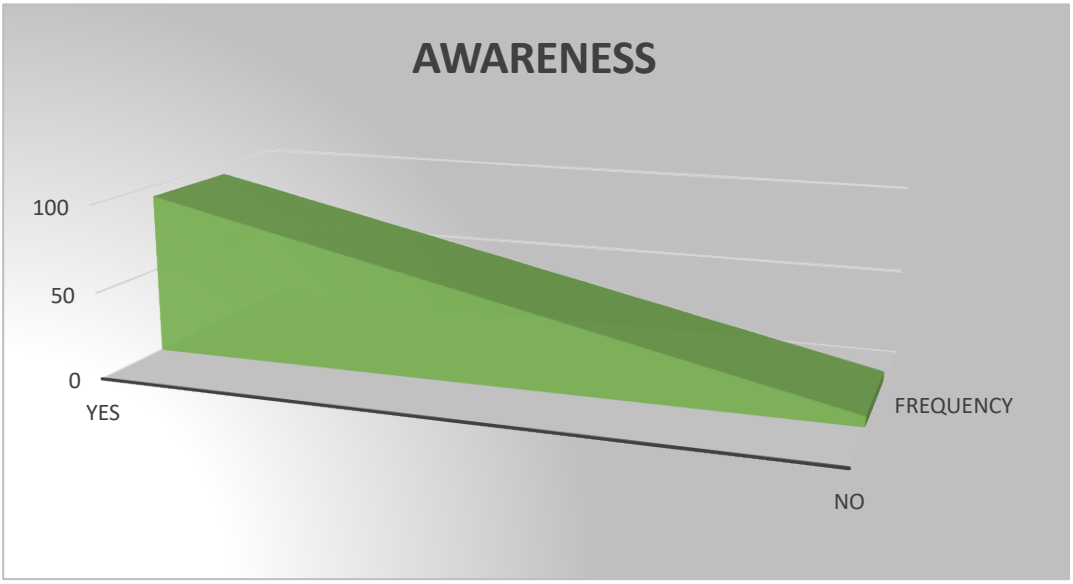


CHART 4.5

INTERPRETATION:

Around 94 percent of the people in Chennai are aware of the increase in demand of electric vehicle. Therefore, people might also be aware of the advantages and disadvantages of electric vehicles. Since the people are aware of the increase in demand, they might also prefer to use E- Vehicles.

SOURCE OF AWARENESS

TABEL 5.6

SOURCE	FREQUENCY	PERCENTAGE
Social Media	72	72
Newspapers	14	14
Journals	7	7
Others	7	7
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

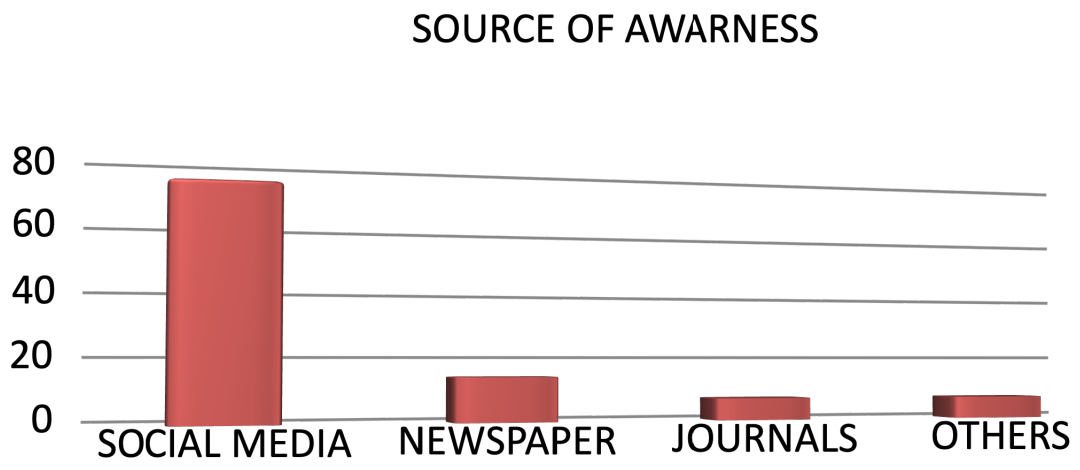


CHART 4.6

INTERPRETATION:

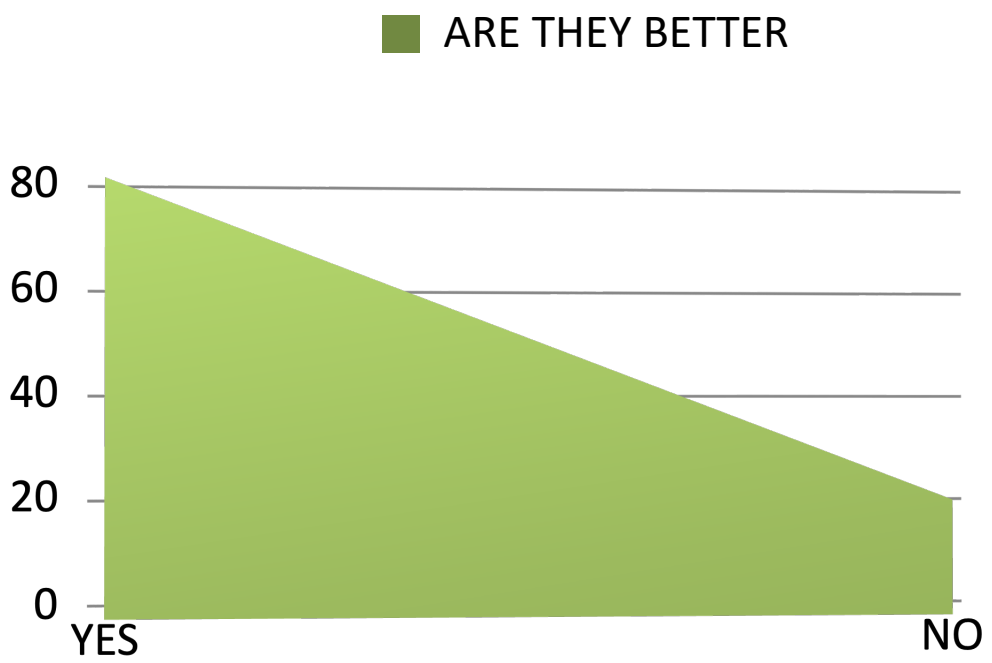
From the above table 4.6, it can be inferred that around 72 percent of the people are awareof the increase in the demand of electric vehicles through the social media and 21 percent

ARE THEY BETTER

TABLE 4.7

BETTER	FREQUENCY	PERCENTAGE
Yes	79	79
No	21	21
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA



INTERPRETATION:

Among the 100 respondents, 79 percent of the people know that electric vehicles are better than regular vehicles which use petrol or diesel. Thus, people accept and prefer to use electric vehicles over regular vehicles. This might lead to people using more E-Vehicles and the demand would increase drastically in Chennai.

ARE THEY SAFE

TABLE 4.8

SAFE	FREQUENCY	PERCENTAGE
Yes	79	79
No	21	21
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

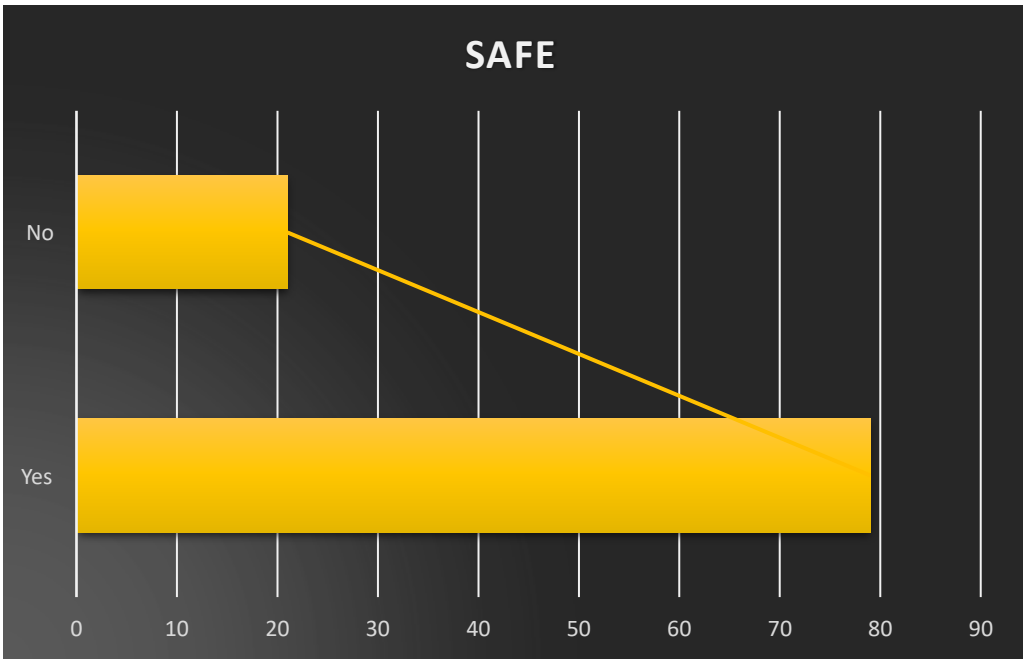


CHART 4.8

INTERPRETATION:

The above table and figure 4.8 show that 79 percent of the people feel safe to use electric vehicles over regular vehicles. They agree that electric vehicles are safer than regular vehicles in few aspects. 29 percent of the people still feel safe to use regular vehicles due to their mindset. Thus, people's mindset will change as more people start using E-Vehicles.

AFFORDABILITY

TABLE 4.9

AFFORDABILITY	FREQUENCY	PERCENTAGE
Yes	18	18
Maybe	47	47
Not sure	28	28
No	7	7
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

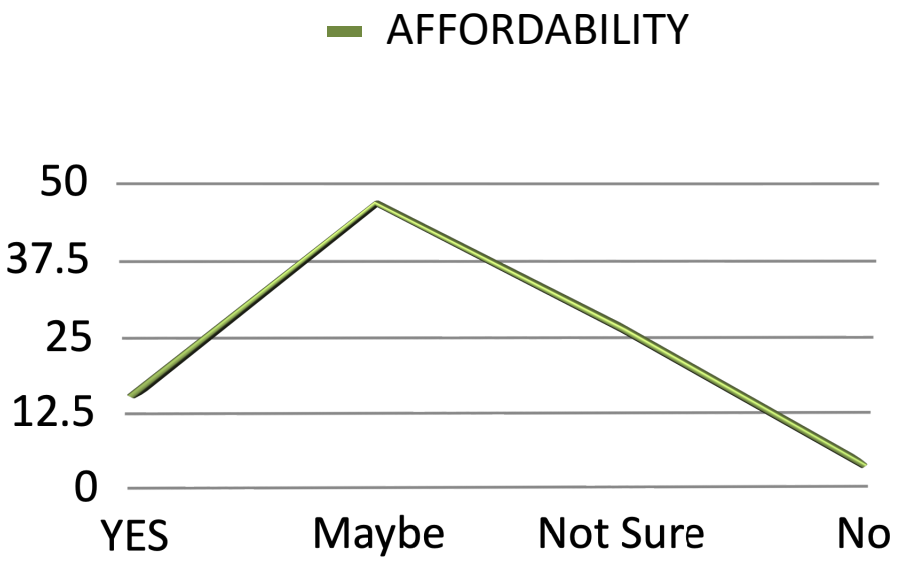


CHART 4.9

INTERPRETATION:

The affordability of electric vehicles is considered to be a major challenge for the people. But among the respondents, 18 percent feel that electric vehicles are affordable nowadays whereas47 percent of the people feel that most of them can afford to buy E-Vehicles and few cannot affordto buy the same. Thus, the more affordable E-Vehicles become, there will be more usage of electricvehicles.

AWARENESS OF BRANDS

TABLE 4.10

BRANDS	FREQUENCY	PERCENTAGE
Yes	66	66
No	34	34
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

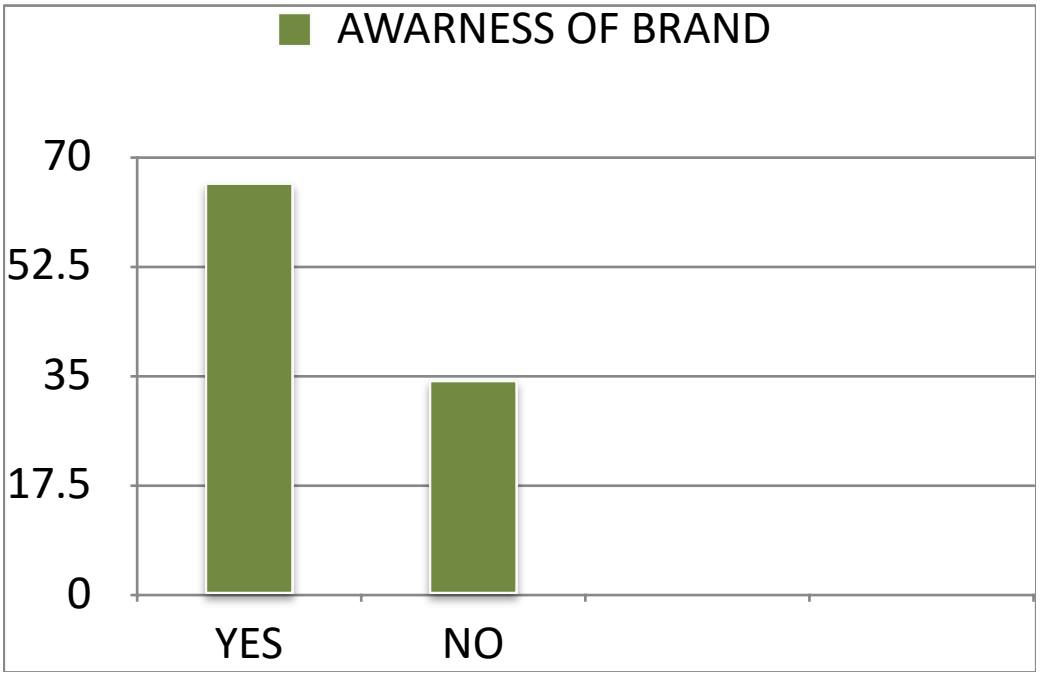


CHART 4,10

INTERPRETATION:

The table and figure 4.10 show that 66 percent of the people are aware of the different brands of E-Vehicles available in the market. There are many different brands which are being introduced into the market. Since people are more aware of the different brands, it is easier for people to compare the cost and other aspects and buy a better electric vehicle.

POLLUTION

TABLE 4.11

POLLUTION	FREQUENCY	PERCENTAGE
Yes	90	90
No	10	10
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

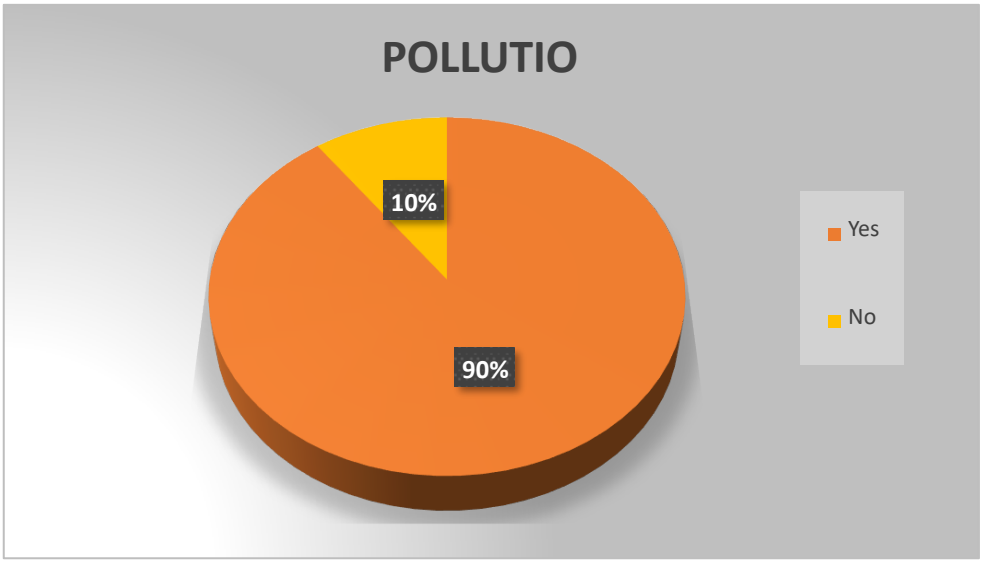


CHART 4.11

INTERPRETATION:

The people accept that electric vehicles cause less pollution than regular vehicles as there is no usage of petrol in electric vehicles. Around 90 percent of the people agree that electric vehicles cause less pollution when compared to regular vehicles. Air pollution and noise pollutionwill be reduced if more people start using electric vehicles. Therefore, electric vehicles play an important role in reducing pollution in our city.

ARE BATTERIES RECYCLABLE

TABLE 4.12

BATTERIES	FREQUENCY	PERCENTAGE
Yes	67	67
No	33	33
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

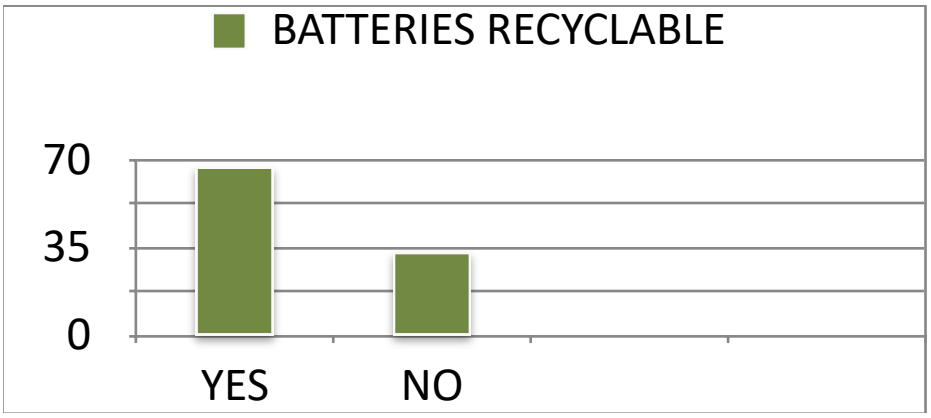


CHART 4.12

INTERPRETATION:

Around 67 percent of the people feel that the batteries of electric vehicles are recyclable. The raw materials used for making the batteries can be recovered and reused whereas fossil fuels only release harmful emissions into the atmosphere. The batteries used in electric vehicles also hasan 8-10year warranty which means that the batteries have a longer life. The batteries can be reusedfor second or third time. Thus, it is far better to use electric vehicles than vehicles which use fossilfuels.

IS PRICE A FACTOR FOR SHIFT TO E-VEHICLES

TABLE 4.13

PARTICULARS	FREQUENCY	PERCENTAGE
Yes	46	46
Maybe	44	44
Not sure	6	6
No	4	4
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

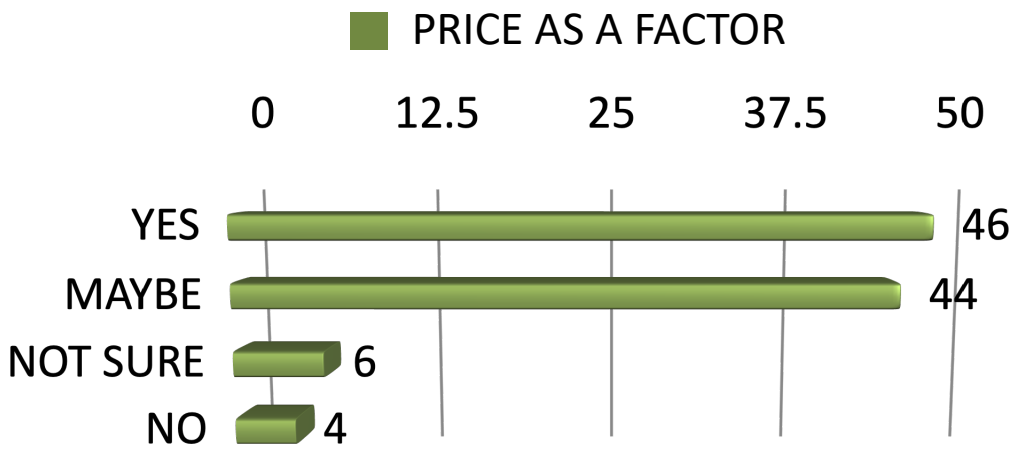


CHART 4.13

INTERPRETATION:

Price is the most important factor that people consider while buying a new product. The priceof electricity is less when compared with fuel. The price of fuel increased drastically which made the running cost of normal vehicles higher. Electric vehicles use electricity for running which is cheaper than the cost of fuel. Therefore, people started to prefer electric vehicles as the running cost is cheaper when compared with normal vehicles. Around 46 percent of the people say that price is the major factor for them shifting to electric vehic

RESPONSE IN MARKETS

TABLE 4.14

RESPONSE	FREQUENCY	PERCENTAGE
Yes	89	89
No	11	11
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

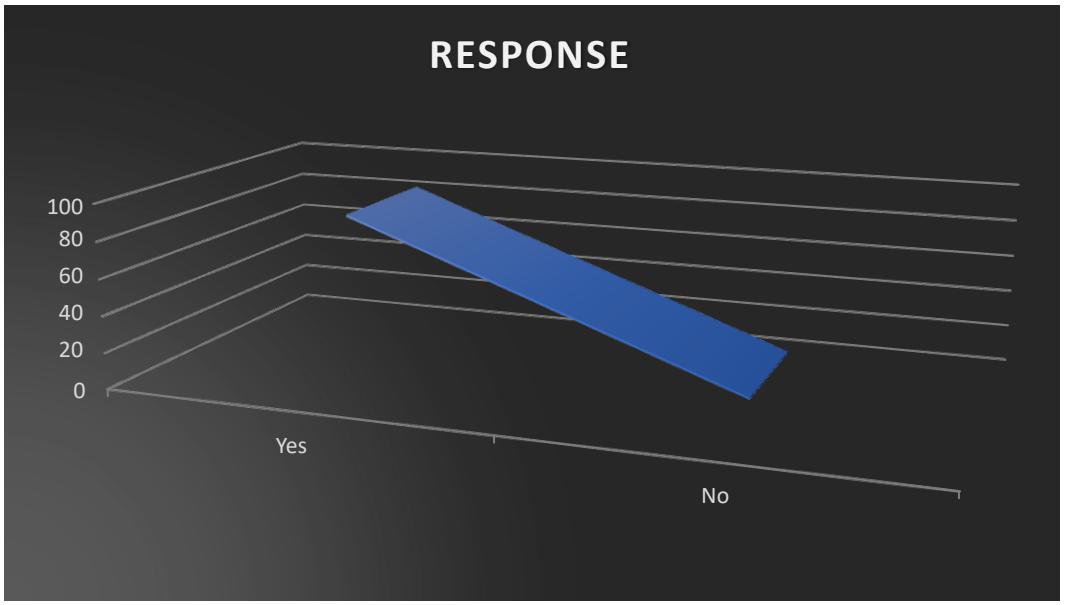


CHART 4.14

INTERPRETATION:

The above table and figure 4.14 show that there is a positive response in the Indian markets for electric vehicles. Since, there is an increase in the demand for electric vehicles the supply is also increased in order to meet the demand. Therefore, there is a positive response for electric vehicles from the people and 89 percent of the people also accept the same.

DIFFERENCE BETWEEN ELECTRIC AND HYBRID VEHICLES

CHART 4.6

PARTICULARS	FREQUENCY	PERCENTAGE
Yes	43	43
No	20	20
Partially yes	37	37
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

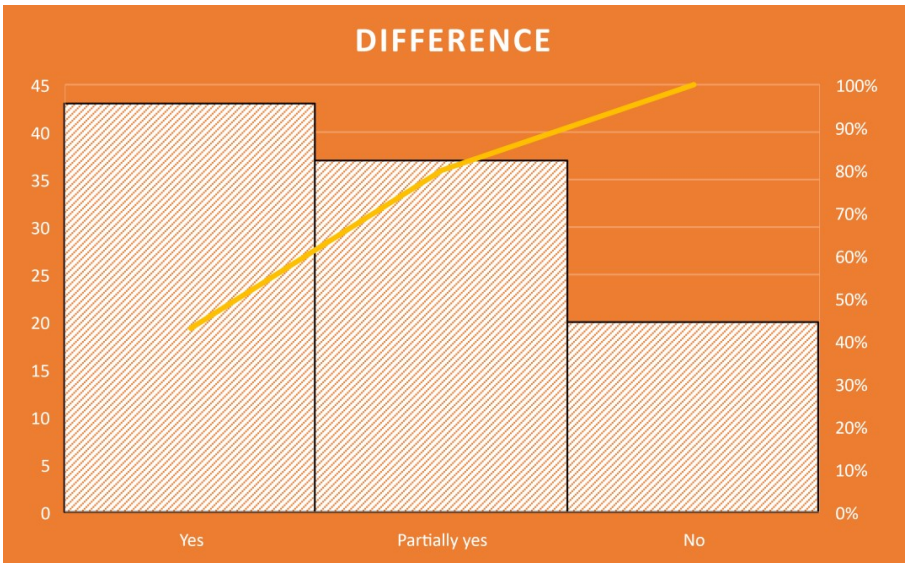


CHART 4.15

INTERPRETATION:

Almost 77 percent of the people are partially or completely aware of the difference between electric vehicles and hybrid vehicles. Electric vehicles run only on battery power whereas hybrid vehicles switch seamlessly between electric energy and petrol. Since the people are aware of the difference, most of them prefer electric vehicles over hybrid vehicles because the net emissions are lower and they require less maintenance.

PRICE RANGE OF E-VEHICLES

TABLE 4.16

PRICE RANGE	FREQUENCY	PERCENTAGE
50,000 - 80,000	21	21
80,000 - 1,00,000	35	35
1,00,00 - 1,50,000	30	30
Above 1,50,000	14	14
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

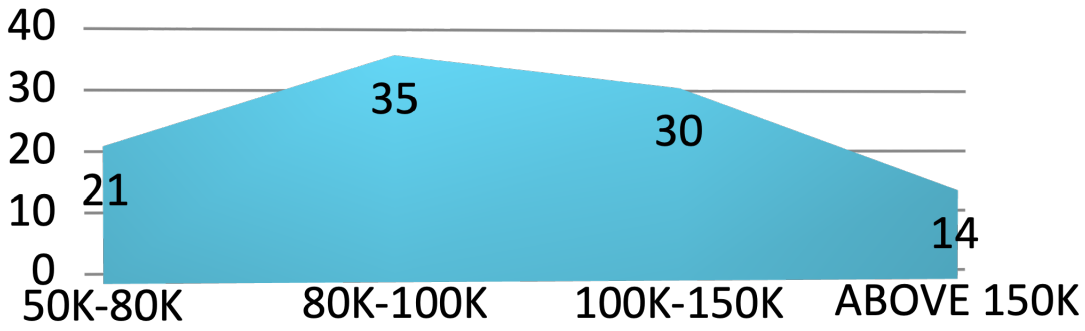


CHART 4.16

INTERPRETATION:

The price of electric vehicles is higher than the normal vehicles. Though the prices are high, people prefer to use electric vehicles because it has many other advantages when compared to normal vehicles. The operating and running cost are lower for electric vehicles. About 35 percent of the people expect the price to be Rs. 80,000 -1,00,000 and 30 percent of the people expect it to be between Rs. 1,00,000 – 1,50,000. Even though the cost of buying is high, the maintenance cost is low. Therefore, people prefer using electric vehicles.

COMPETITION - COST PER KILOMETER

TABLE 4.17

PARTICULARS	FREQUENCY	PERCENTAGE
Yes	18	18
No	82	82
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

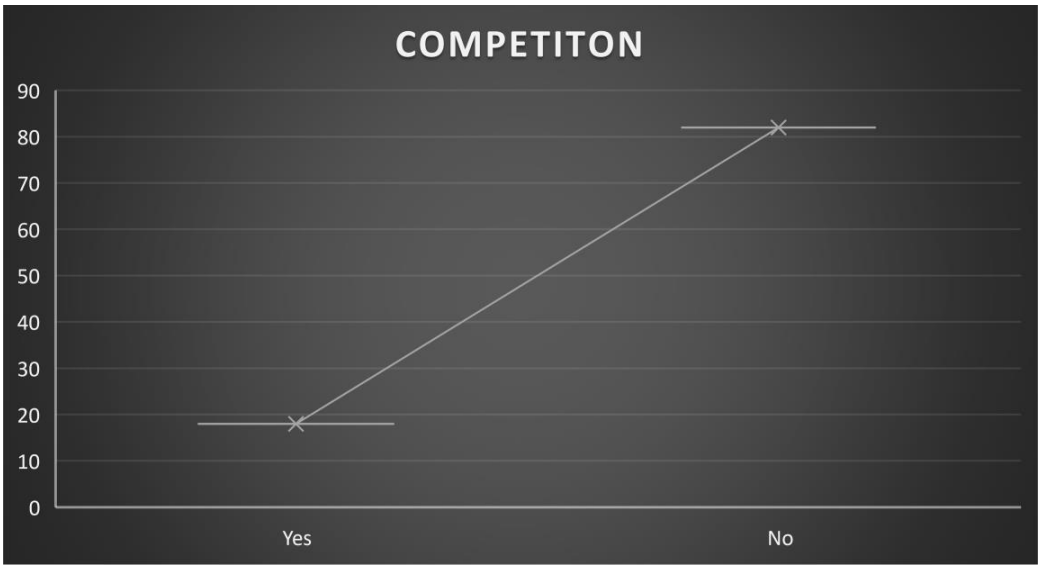


CHART 4.17

INTERPRETATION:

The fossil fuel vehicles cannot compete with electric vehicles under the cost per kilometre as the prices of electricity and petrol are not the same. The price of petrol is higher than the price of electricity and so the cost of fossil fuel vehicles per kilometre is higher than the cost of electric vehicles per kilometre. Around 82 percent of the people also agree that the fossil fuel vehicles cannot compete with the electric vehicles in this particular aspect.

DEMAND FOR E-VEHICLES

TABLE 4.18

PARTICULARS	FREQUENCY	PERCENTAGE
Met instantly	24	24
Waiting period prevails	76	76
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

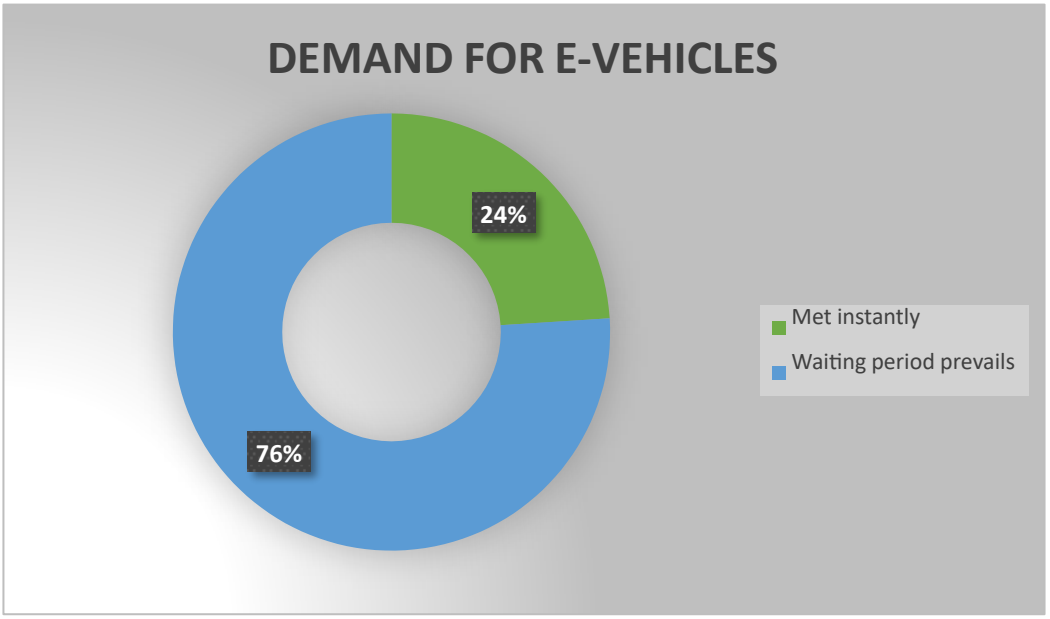


CHART 4.18

INTERPRETATION:

The demand for electric vehicles is not met instantly. Almost 24 percent of the people agree that the demand is not met instantly. There always prevails a waiting period and the customers have to wait for their vehicle after booking. Among the 100 respondents, 76 percent of the people agree that the waiting period prevails for electric vehicles.

IS WAITING PERIOD BECAUSE OF HIGHER DEMAND

CHART 4.19

PARTICULARS	FREQUENCY	PERCENTAGE
Yes	60	78.9
No	16	21.05
TOTAL	**76**	**76**

SOURCE: PRIMARY DATA

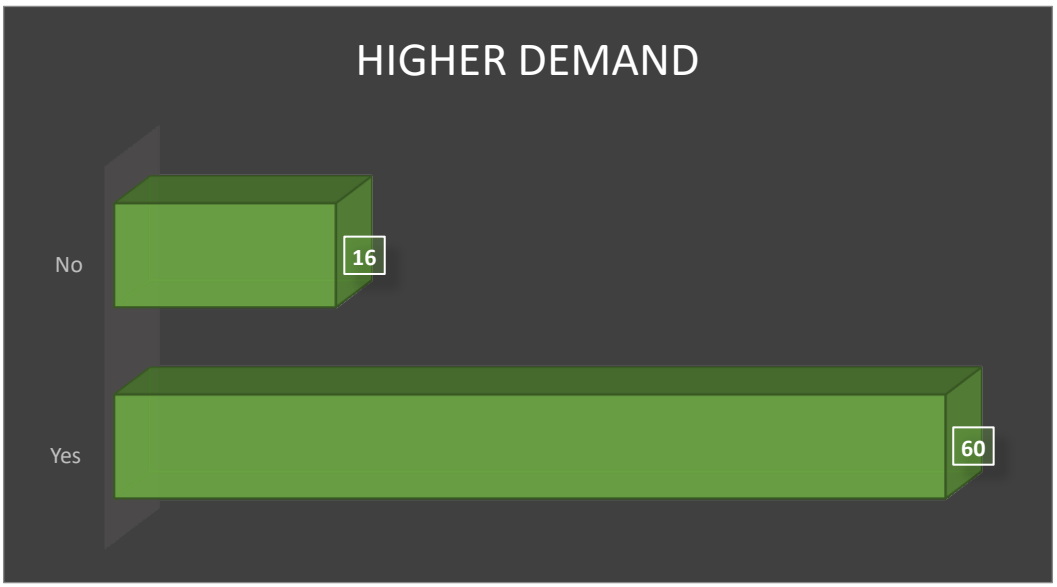


CHART 4.19

INTERPRETATION:

The above table and figure 4.19 show that the waiting period prevails because of the higher demand for electric vehicles. Out of the 76 percent of the people who agreed that waiting period prevails, 60 of them also believe that it is because of the higher demand for electric vehicles in Chennai. Thus, the main reason for prevailing waiting period is the higher demand for electric vehicles.

CHARGING STATIONS

TABLE 4.20

CHARGING STATIONS	FREQUENCY	PERCENTAGE
Yes	15	15
No	85	85
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

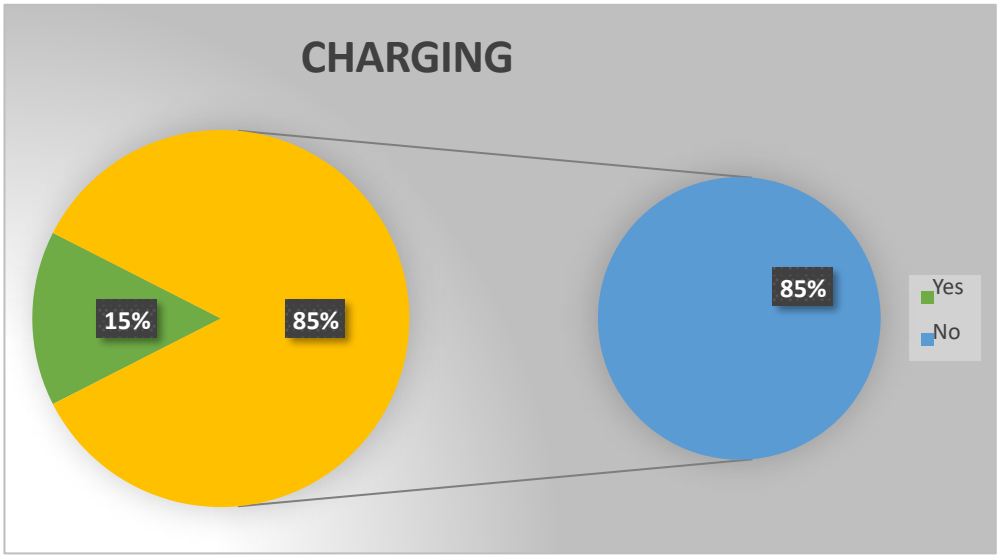


CHART 4.20

INTERPRETATION:

Chennai has very minimum number of charging stations for electric vehicles. From the above figure and table 4.20, it can be inferred that people accept that there are no enough charging stationsin Chennai. Almost 85 percent of the people have agreed that there are no enough charging stations.Thus, it is considered one of the major drawbacks for E-Vehicles as charging stations are considered very essential for the users.

GOVERNMENT INITIATIVES

TABLE 4.21

PARTICULARS	FREQUENCY	PERCENTAGE
Yes	47	47
No	53	53
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

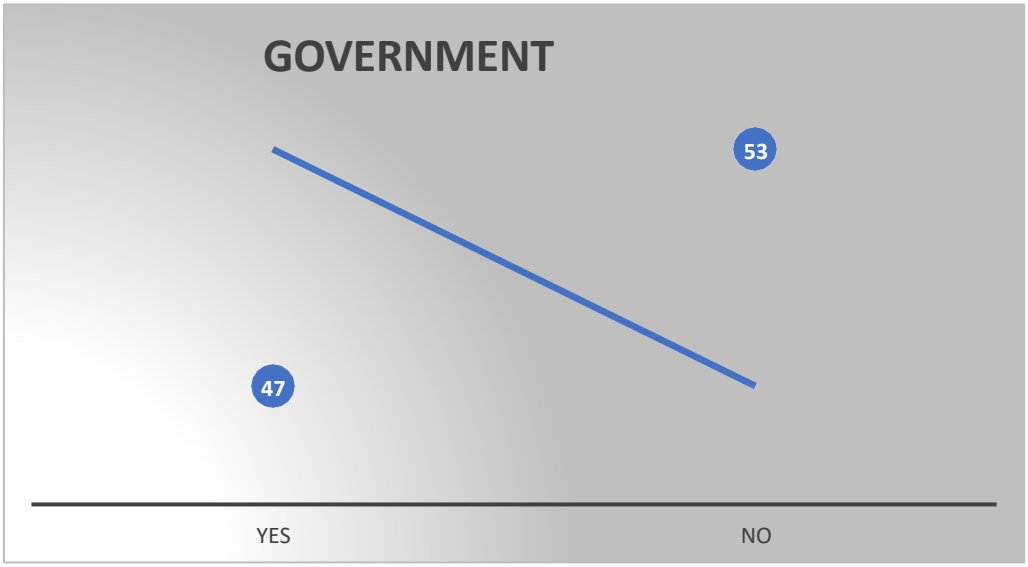


CHART 4.21

INTERPRETATION:

From the above table and figure, it can be inferred there was no enough initiatives taken by the government for promoting electric vehicles. But the government has taken certain initiatives for promoting electric vehicles. Almost 53 percent of the people are not aware of the initiatives taken by the government. The government also did not emphasise more on those initiatives. Around 47 percent of the people are aware of the initiatives and agree that government has made policies for promoting the usage of E-Vehicles.

OPERATING COST

TABLE 4.22

PARTICULARS	FREQUENCY	PERCENTAGE
Yes	38	38
Maybe	39	39
Not sure	19	19
No	4	4
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

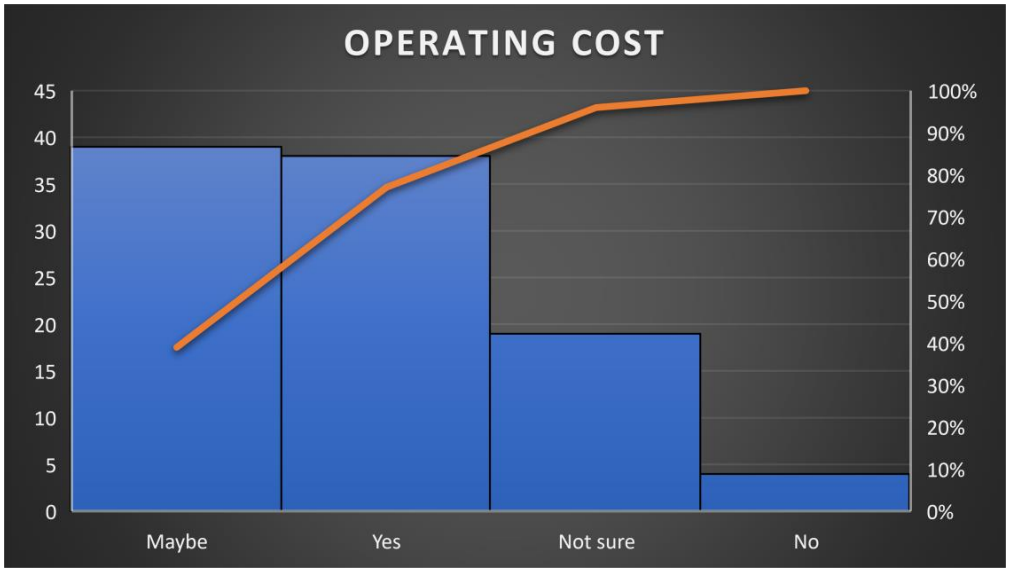


CHART 4.22

INTERPRETATION:

The above figure 4.22 shows that the operating cost of E-Vehicles is cheaper when comparedto vehicles which use fossil fuels. Around 77 percent of the people say that the operating cost is comparatively cheap. Only 12 percent of the people are not sure of the operating cost as they are not aware of the benefits of electric vehicles. Thus, it is one of the major reasons for people accepting electric vehicles and using the same.

MAINTENANCE

TABLE 4.23

PARTICULARS	FREQUENCY	PERCENTAGE
Electric vehicles	17	17
Fossil fuel vehicles	33	33
Both A & B	43	43
Neither A nor B	7	7
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

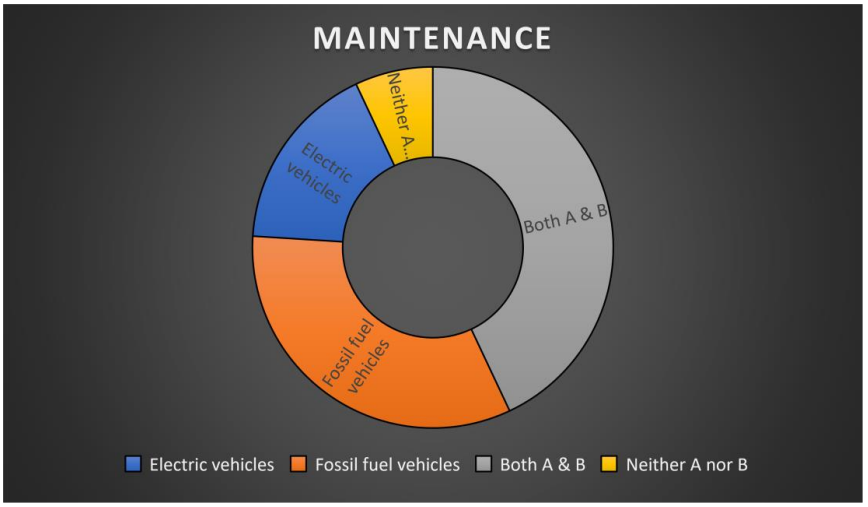


CHART 4.23

INTERPRETATION:

Maintenance of vehicles is one another important aspect checked by people. All vehicles require maintenance as without maintenance the vehicle will not run smoothly. Electric vehicles when compared with fossil fuel vehicles need less maintenance. Around 33 percent of the peoplesay that fossil fuel vehicles require more maintenance. Though fossil fuel vehicle requires more maintenance, electric vehicles also need to be maintained. Around 43 percent of the people say that both the vehicles require enough maintenance.

TWO-WHEELER BRANDS

TABLE 4.24

TWO-WHEELER	FREQUENCY	PERCENTAGE
Ather	49	49
Ola	16	16
Revolt	13	13
TVS	22	22
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

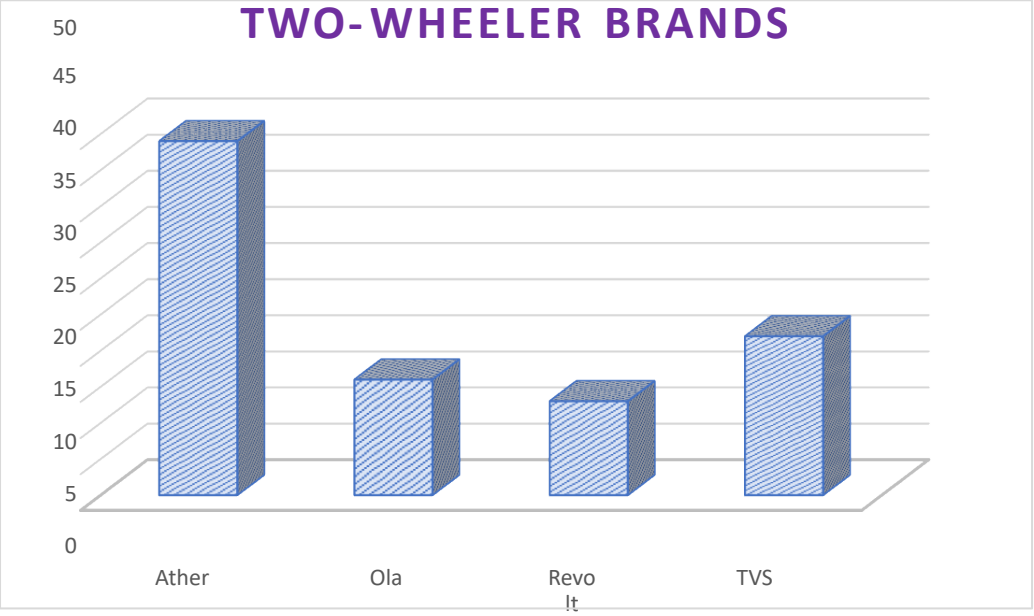


CHART 4.24

INTERPRETATION:

Most of the people are aware of the different brands of two-wheelers in electric vehicles. The most preferred two-wheeler brand is Ather as opted by 49 percent of the people. Nowadays, there are many E-Vehicles on roads among which Ather is one of them. The next preferred electric vehicle is TVS and 22 percent of the people prefer using this vehicle. There are many other brandsbut these two are the most commonly used brands in electric vehicles.

FOUR-WHEELER BRANDS

TABLE 4.25

FOUR-WHEELER	FREQUENCY	PERCENTAGE
Tata	51	51
Hyundai	29	29
MG	12	12
Mercedes Benz	8	8
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

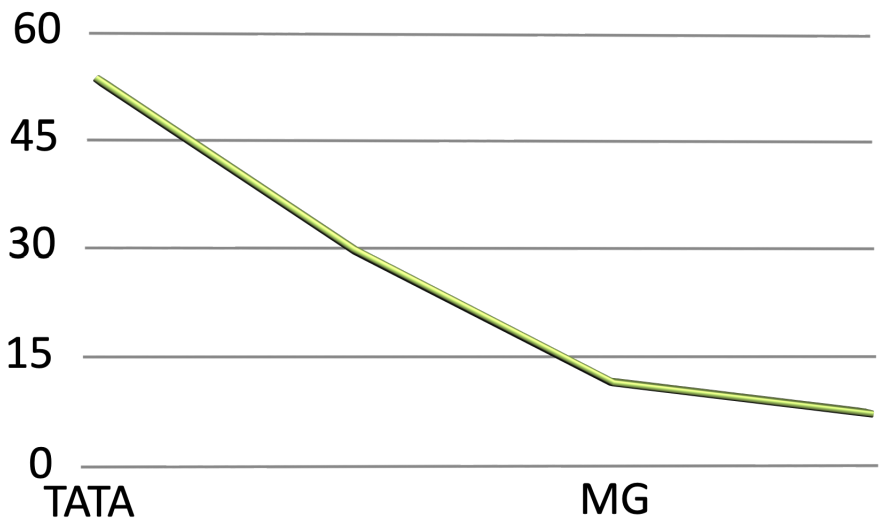


CHART 4.25

INTERPRETATION:

There are different brands of four-wheelers also in electric vehicles. The most preferred electric car is Tata as 51 percent of the people prefer using that car. Most of the people are comfortable using Tata electric cars. The next most commonly used is Hyundai electric cars which are also found on roads. Thus, people are more aware of the different brands and compare every brand before purchasing the vehicle.

HINDRANCES OF E-VEHICLES

TABLE 4.26

HINDRANCES	FREQUENCY	PERCENTAGE
Mileage	35	35
Lack of charging stations	71	71
Higher costs	50	50
Lack of service stations	52	52
Non-Reliability	24	24

SOURCE: PRIMARY DATA

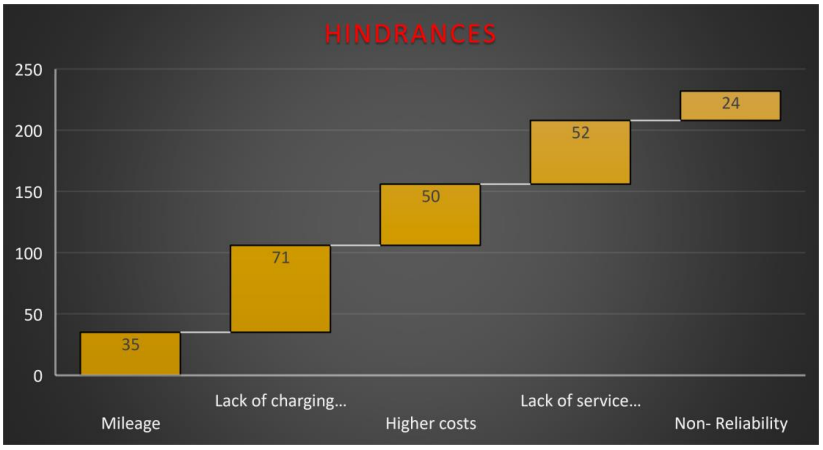


CHART 4.26

INTERPRETATION:

There are many hindrances regarding electric vehicles for the people. Lack of charging stations is considered the biggest hindrance as people stay back from using electric vehicles because of this reason. Around 71 percent of the people feel this as the major hindrance. 52 percentof the people feel lack of service stations as another major hindrance and 50 percent of them feel that the cost of electric vehicles is high which makes them reluctant for using electric vehicles.

COMPLETELY OCCUPYING MARKET

TABLE 4.27

PARTICULARS	FREQUENCY	PERCENTAGE
2025	8	8
2027	20	20
2029	5	5
2030	67	67
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

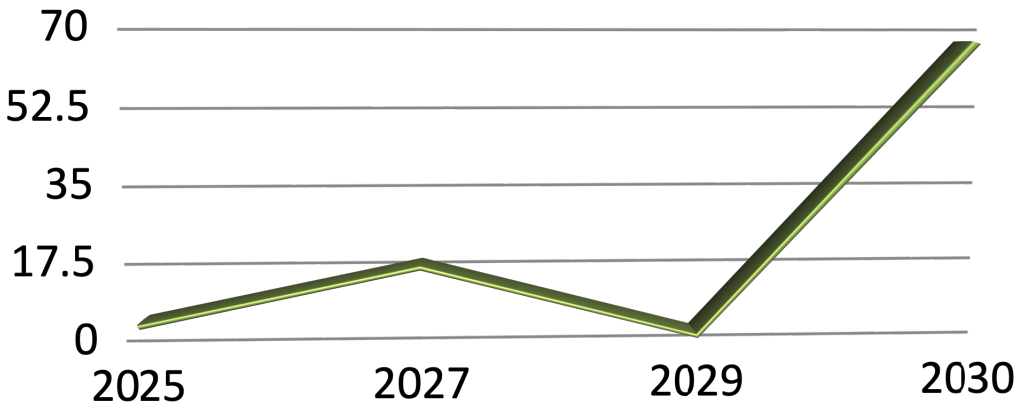


CHART 4.27

INTERPRETATION:

The above table and figure 4.27 show that electric vehicles will completely occupy the market in the year 2030. Most of the people will shift from using fossil fuel vehicles to electric vehicles and will also start feeling comfortable using the same. Around 67 percent of the people feel that electric vehicles will completely occupy the market and the roads will be having more electric vehicles in the year 2030.

E-VEHICLES SAFEGUARD THE NATION

TABLE 4.28

PARTICULARS	FREQUENCY	PERCENTAGE
Agree	91	91
Disagree	9	9
TOTAL	**100**	**100**

SOURCE: PRIMARY DATA

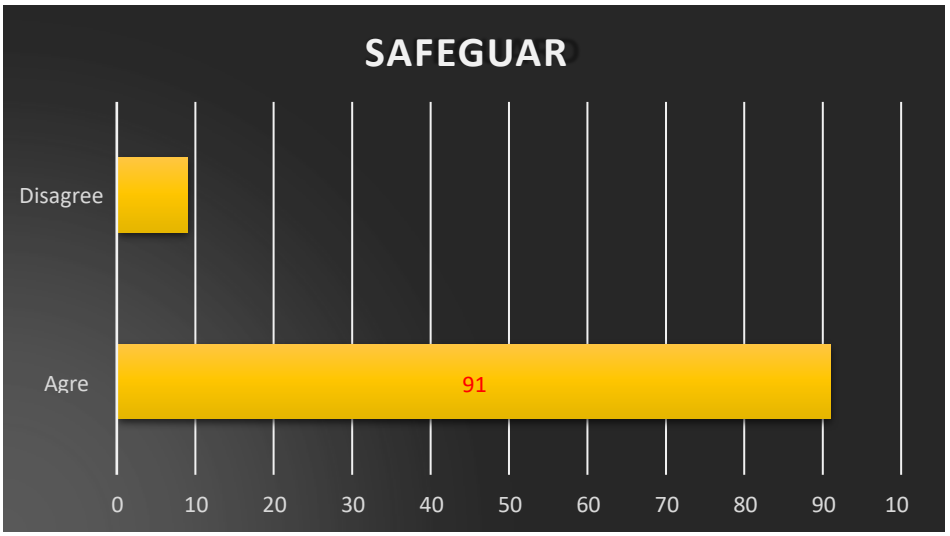


CHART 4.28

INTERPRETATION:

From the above figure and table, it can be inferred that electric vehicles will play an important role in safeguarding the nation from various harmful substances. Among the 100 respondents, 91 percent of the people agree to the fact that electric vehicles are going to safeguard the nation from pollution. Electric vehicles help in controlling the air and noise pollution as they do not produce any sound and do not use fossil fuels. Thus, electric vehicles are advisable to safeguard the nation from pollution.

FREQUENCY OF MONTHLY INCOME AND AFFORDABILITY
INDEPENDENT T-TEST

TABLE 4.29

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Affordability	93	2.10	.708	.073
Income	100	3.07	1.695	.170

One-Sample Test

	Test Value = 0						
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference	
			One-Sidedp	Two-Sidedp		Lower	Upper
Affordability	28.556	92	.001	.001	2.097	1.95	2.24
Income	18.110	99	.001	.001	3.070	2.73	3.41

HYPOTHESIS TESTING:

H0: There is no significant difference between the monthly income and affordability of electricvehicles for the people.

H1**:** There is significant difference between the monthly income and affordability of electricvehicles for the people.

INTERPRETATION:

From the above observation, it is found that the significant value of the T-test is 2.097. Since it is lesser than the P value 2.24, the null hypothesis is rejected. The alternative hypothesis is accepted at 99% confidence interval with 1% error. Therefore, there is significant difference between the monthly income and affordability of electric vehicles for the people.

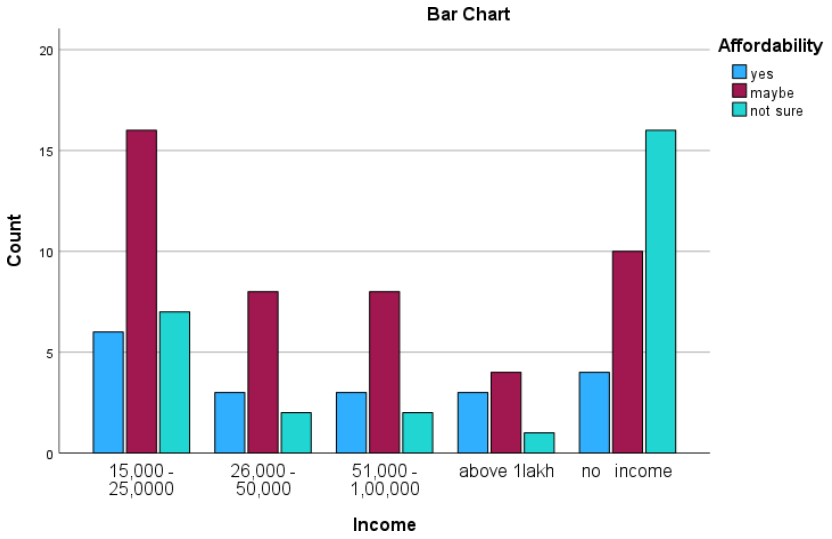


CHART 4.30

INTERPRETATION

From the above figure 4.29, it can be inferred and proved that there is significant difference between the monthly income and affordability of electric vehicles as people with no income have said that there is high probability of affording an electric vehicle. People who earnbetween Rs 15,000 – 25,000 feel that most of them can afford to buy an electric vehicle. Peoplewith high income feel electric vehicle are still no affordable for many people.

CHAPTER - V

CHAPTER – V

FINDINGS, SUGGESTIONS & CONCLUSIONS

1. FINDINGS:

❖The number of female respondents is more than the male respondents. Out of the 100 respondents, 60 are female members which signifies that electric vehicles are morepreferred by females than males.

❖Around 36 percent of the people earn an income between Rs. 50,000-1,00,000 which makesit easier for them to afford an electric vehicle.

❖Out of the 100 respondents, 54 percent of the people own an electric vehicle.

❖In Chennai, 94 percent of the people are aware of the increase in demand of electric vehicles.

❖Social media has played an important role in making people aware of the increase in demand for electric vehicles. 72 percent of the people are aware of the demand only throughsocial media.

❖Electric vehicles are better than traditional fossil fuel vehicles. Thus, people accept and prefer to use electric vehicles over regular vehicles.

❖Electric vehicles are considered safe to use when compared with regular vehicles. Around79 percent of the people feel safe to E-Vehicles.

❖Over the time, more people can afford to purchase E-Vehicles. 47 percent of the people feel that most of them can afford to buy the same.

❖There are different brands of E-Vehicles available in the market and 66 percent of the people are aware of the various types of brands.

❖Electric vehicles cause less pollution than fossil fuel vehicles as there is no usage of petrol in electric vehicles. About 90 percent of the people agree that air pollution and noise pollution have been reduced.

❖The batteries used in electric vehicles are recyclable and can be used for long terms. The batteries can also be reused for the second or third time. The batteries have a longer life.

❖There are no enough charging stations in Chennai which is considered the major drawbackfor electric vehicles.

❖Around 46 percent of the people state that price is the major factor for them shifting to electric vehicles. The running cost of electric vehicles is cheaper than the cost of regular vehicles.

❖Electric vehicles have a positive response in the markets as there is an increase in demand.As the demand increases, the supply also increases in the markets.

❖There is a difference between electric vehicles and hybrid vehicles. Almost 77 percent of the people are partially or completely aware of the differences.

❖The price range of electric vehicles is expected to be between Rs. 80,000 – 1,50,000 depending on the kilometre range of the particular vehicle.

❖The fossil fuel vehicles cannot compete with electric vehicles in any aspect. The cost per kilometre has greater differences as the prices of electricity and petrol are not equal.

❖The waiting period prevails because of the higher demand for electric vehicles. Around 79percent of the people agree that it is because of the increased demand.

❖The government has taken initiatives for promoting the usage of electric vehicles in TamilNadu but 53 percent are not aware of the initiatives taken by the government.

❖The operating cost of E-Vehicles is cheaper when compared to vehicles which use fossil fuels. Thus, it is one of the reasons for people accepting and using electric vehicles.

❖Electric vehicles require less maintenance when compared with fossil fuel vehicles. Around 33 percent of the people say that fossil fuel vehicles require more maintenance.

❖The most preferred two-wheeler brand in electric vehicles is Ather which is followed by TVS. 49 percent of the people prefer Ather to be the best brand.

❖The most preferred four-wheeler brand in electric vehicles is Tata which is followed by Hyundai. 51 percent of the people prefer Tata to be the best brand in Indian markets.

❖There are many hindrances regarding electric vehicles for the people. Lack of charging stations is considered the biggest hindrance. Other hindrances include lack of service stations and higher costs of electric vehicles.

❖Around 67 percent of the people feel that electric vehicles will completely occupy the market and the roads will be having more electric vehicles in the year 2030.

❖Electric vehicles are advisable to safeguard the nation from pollution as it helps in controlling air and noise pollution. Electric vehicles are the most environment friendly product as the emissions is zero.

2.SUGGESTIONS:

•Some of the suggestions to increase the usage of electric vehicles in Chennai, Tamil Nadu are:

•Incentives and subsidies: The Indian government can offer financial incentives such as tax rebates, subsidies, and reduced registration fees to make electric vehicles more affordablefor consumers.

•Public awareness campaigns: The government can launch public awareness campaigns

to educate consumers about the benefits of electric vehicles and to dispel common misconceptions about them.

•Charging infrastructure: The government can invest in building a robust network of charging stations across the country to alleviate range anxiety and make it more convenientfor people to charge their electric vehicles.

•Partnerships with private sector: The government can collaborate with private sector companies to offer incentives such as discounts on EV charging, installation of charging stations at offices, etc.

•Clean energy transition: The Indian government can prioritize the transition to clean energysources such as wind and solar to ensure that the electricity used to power electric vehiclesis also clean and sustainable.

•Battery recycling and disposal: The Indian government can implement policies and regulations to ensure the responsible disposal and recycling of EV batteries to minimize their impact on the environment.

•Local manufacturing: Encouraging local manufacturing of electric vehicles and their components can not only reduce the cost of electric vehicles but also create job opportunities Overall, a combination of these strategies can help increase the usage of electric vehicles in the Indian market, promoting sustainable and clean transportation.

CONCLUSION:

•Electric vehicles represent a promising alternative to traditional gas-powered cars, offering numerous benefits such as lower emissions, reduced operating costs, and improved performance. The research conducted highlights that while the initial investment cost of electric vehicles is often higher than their gas counterparts, the long-term savings can be significant. Furthermore, advancements in battery technology and charging infrastructure continue to make electric vehicles more accessible and convenient for consumers.

•However, it is important to note that electric vehicles are not a one-size-fits-all solution and may not be suitable for all drivers, particularly those who require long-range travel or do not have access to reliable charging infrastructure. Additionally, the production and disposal of batteries can have environmental implications that need to be carefully managed.

•Overall, the research project suggests that electric vehicles have the potential to play a crucial role in the transition to a more sustainable transportation system. However, it will requirecollaboration between industry, government, and consumers to fully realize this potential and address the challenges that arise along the way.

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ANNEXURE - I

QUESTIONNAIRE

A study on Role of electric vehicles on Reducing Pollution and future of electric vehicle in Indian market

1. Name of the respondent: 2. Gender:
a) Male b) Female 3. Age:

a) 20-30yrs b) 30-40yrs 4. Monthly Income:

c) Prefer not to say

c) 40-50yrs

d) Above 50yrs

a) Rs 15000-25000 b) Rs 25000-50000 c) Rs 50000-1 Lakh d) Above 1 Lakh

5.Do you own an electric vehicle?
a) Yes b) No
6. Are you aware of the increase in the demand of Electric Vehicles in India?
a) Yes b) No
7. If yes, how were you aware of the increase in the demand of Electric Vehicles? a) Newspapers b) Journals c) Social Media d) Others
8. Are Electric Vehicles better than regular vehicles?
a) Yes b) No
9. Are Electric Vehicles safe to use?
a) Yes b) No

10. Are E-Vehicles affordable for the people in India?
a) Yes b) Maybe c) Not sure d) No

11. Are you aware of the different brands of Electric Vehicles that are available in Indian markets?

a) Yes b) No

12. Do you think Electric Vehicles cause less pollution compared to the traditional fossil fuel vehicles?

a) Yes b) No

13. Are the batteries used in Electric Vehicles recyclable?

a) Yes b) No

14. Do you think the rise in price of fossil fuels is one of the major factors for people shifting to Electric Vehicles in India?

a) Yes b) Maybe c) Not sure d) No

15. Is there a positive response for E-Vehicles in our Indian markets?

a) Yes b) No

16. Are you aware of the difference between Electric Vehicles and Hybrid V ehicles?

a) Yes b) No

17. What is the expected price range while purchasing an E-Vehicle?

a) Rs 50,000-80,000 b) Rs 80,000-1,00,000 c) Rs 1,00,000-1,50,000 d) More than Rs 1,50,000

18. Do you think the fossil fuel vehicles can compete with the Electric Vehicles in terms of cost per kilometer?

a) Yes b) No

19. Do you think the demand for E-Vehicles is met instantly or is there a waiting period for buying the vehicles?

a) Met instantly b) Waiting period prevails

20. If waiting period prevails, is it because of the higher demand for E-Vehicles in the market?

a) Yes b) No

21. Are there enough charging stations in our country for Electric Vehicles?

a) Yes b) No

22. Has the government taken any initiative to promote Electric Vehicles in Chennai?

a) Yes b) No

23. Do you think the operating cost of E-Vehicles is cheap when compared to vehicles which use fossil fuels?

a) Yes b) Maybe c) Not sure d) No

24. Which vehicle requires more maintenance?

a) Electric Vehicle b) Fossil fuel Vehicle c) Both A and B d) Neither A nor B 25. Which is the most preferred Two-wheeler brand in Electric Vehicles?

a) Ather b) Ola c) Revolt d) TVS

26. Which is the most preferred Four-wheeler brand in Electric Vehicles?

a) Tata b) Hyundai c) MG d) Mercedes Benz

27. Which aspects of electric vehicles are considered a big hindrance for the people?

a) Mileage b) Lack of Charging stations c) Higher costs
d) Lack of Service centers e) non-Reliability

28. In which year do you think the electric vehicles will completely occupy the market?

a) 2025 b) 2027 c) 2029 d) 2030

29. Do you agree that Electric Vehicles are more advisable to safeguard the nation from pollution?

a) Agree b) Disagree

30. Suggestions for promoting the demand for E-Vehicles in the Indian market.