

# Consumers' Perception towards Electric Vehicles in India

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## ABSTRACT

● Purpose: Analyzing the important and key factors which affect consumers' the purchasing intention of consumer and their actual purchasing behavior with respect electric vehicles as a substantial percentage of the demand for oil and gas comes from the vehicle owners (For Indian Cities)

● Proposed Design/ Methodology/ Approach: Electronic Questionnaires are used for data collection from the potential customers. Statistical analysis techniques are utilized to analyze the responses of the customers.

● Practical/ Theoretical Implications : This study will help us in understanding the impact on the oil and gas demand in India in the short term (5 years) on basis of the perception of the consumers towards the EVs and their propensity to buy EVs.

● Originality/ Value: As per the Global EV Outlook by IEA (International Energy Agency), use of electric vehicles is expected to rise from 4 million vehicles in 2018 to 120 million vehicles by 2030. Subsidies and along with technological improvements are expected to aid in increasing the market share of EVs over the coming decade. With the growing sensitivity towards environment and development in technology, people are gradually shifting towards hybrid and electric vehicles for their commutes. The study explores the Indian customers' perspective with respect to EVs and their willingness in accepting it as mode of commute whilst considering the governments stand on the introduction of EVs in the Indian transport system.

## Keywords

Electric Vehicles, Energy, Oil, Gas, Consumer Behaviour

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## Introduction

Unprecedented changes in the climate and the rising awareness around this combined with the atmosphere for technical innovation in the world is challenging the status quo for several sectors. An example for the same is the advent and promotion of electrical mobility for transportation. In the long run, the electric vehicles which can help in bringing down the air pollution and emissions of greenhouse gases might prove to be threat for the oil and gas industry. Globally, the transportation sector is one of the major sectors that consume fossil fuels and its products. The development of electric vehicles is still at a nascent stage with their total percentage being less than 2% globally. However, with the pace of technological advancements and development, this percentage is expected to increase in the coming decades.

### The Current Scenario in India:

"India is predicted to emerge as the one of the highest contributors to the consumption and growth of petroleum around the world by a non OECD (Organisation for Economic Co-operation and Development).

As per a report by IBEF (India Brand Equity Foundation), the imports of oil in India rose sharply to US \$87.37 billion in 2017-2018 from US \$70.72 billion in 2016-2017. Both the private sector companies and the PSUs in the oil and gas sector have significant contributions to the Indian Economy. As per a report by Invest India, all activities along the petroleum sector value chain contribute around 15% towards India's GDP.

In the early 2019, the Indian Government announced a scheme Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME-2) to promote electric mobility in India. The scheme comes with an outlay of 1,000 crores. The push for electrical vehicles from the Government of India comes at a time when the automobile industry is going through an upgrade from Bharat Stage –IV (BS-IV) to Bharat Stage –VI (BS-VI) fuels.

Niti Ayog, the major brain behind the policies of the Indian government, has suggested that electric vehicles especially with 3-wheelers and 2-wheelers and below 150 cc should ply on the Indian roads by 2025. India, being a net oil importer nation, spends a significant part on the oil imports, amounting to US \$112 billion or INR 7.83 lakh crores on importing oil from 2018-2019. As per the Federal think tank, the NITI Ayog, this large spending on the oil imports could be brought down with a complete switch and adoption to Electric Vehicles. Apart from the benefits from reduction in air pollution, a reduction in the oil imports is also one of the reasons for adoption of Electric Vehicles.

To propel the massive adoption and usage of electric vehicles, an area requiring development is the battery manufacturing for these electric vehicles. As of now, India doesn't have large scale or cost-effective battery manufacturing facilities. Another factor is the adequate presence of the charging stations and for that the infrastructure needs to be conducive.

### Oil Consumption in India:

The oil consumption of India has surged in the last 30 years. As per a report by International Energy Agency (IEA), it has increased progressively at a Compound Annual Growth Rate (CAGR) of 5.17% from 1990 to 2017. The major factors responsible for this growth are the increase in population and the rapid economic development especially in the last couple of decades. Currently, India consumes over 1,87,000 ktoe of oil (kilo tonnes of oil equivalent). This represents around 5% of the total global oil demand. The demand for gas and diesel accounts for 39% of the total demand for oil. The transport sector accounts up to 48% of the total oil demand in India and is the highest user of oil and gas products in India. The oil demand from the transport sector has witnessed a CAGR of 6.26% from 1190 to 2017. In the transport sector, the personal vehicles account for up to 40% of the total oil consumption, hence this research has been done from the view of the personal vehicles.

### Overview of the Electric Vehicle (EV) Segment:

“The EV market segment primarily comprises of: two wheelers, high speed three wheelers, low speed two wheelers, commercial electric cars, personal electric cars, and electric buses. Due to the “Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India” (FAME India) scheme by the government, the market for Electric vehicles has seen a significant growth in the last 2 to 3 years. A total of 7,59,000 units of EV were sold in India in the year 2019. Of these, three wheelers were 83% and two wheelers accounted for 16.5%. However, as per Auto News, the sales of Electric Vehicles have crossed 750,000 units in financial year 2019 but the implementation of FAME II may spoil the growth. As per a BIS Research, Analysis 2030, the market for EV is expected to have a growth at a CAGR of 43.13% during 2019 to 2026 period.

This growth primarily will be driven by government subsidies, tax benefits, entry of domestic battery manufacturers and reduction in price due to economies of scale. It has been estimated that by 2030, electric two-wheelers will constitute around 29% of the active vehicle stocks while electric four-wheelers will constitute around 44% of the active vehicle stocks.” [1]

### Factors Responsible for Adoption of Electric Vehicles:

The penetration and adoption of Electric Vehicles will highly depend on a variety of factors such as procurement cost, operational cost, maintenance cost, vehicle range, charging infrastructure and the enabling environment. As of now, on an average the prices of electric vehicles are higher as compared to the conventional comparable gasoline based vehicles. This is majorly due to the high cost of the advanced Lithium ion batteries. However, with improved and greater access to innovations in technology, entry of domestic players, and economies of scale resulting from an increase in demand, due to which the cost of the battery is expected to come down which will eventually make the EVs more affordable. In terms of running per kilometre, the operating cost of an electric vehicle is lower than that of conventional gasoline based vehicles. The major reasons for this difference is the higher efficiency of the electric engines

as compared to the conventional engines and lower and more stable prices of electricity as compared to higher and volatile prices of gasoline. Additionally, the subsidies by the Government under the FAME scheme and lower GST rates would help in providing for a conducive environment for the adoption of electric vehicles and expansion of the infrastructure network required for charging. Due to the very nature of Electric Vehicles, these have fewer moving parts as compared to the conventional gasoline based vehicles. This is expected to lower the maintenance cost of EVs. These factors increase the probability of the penetration of EVs in everyday life. If these estimations become true, then the electric vehicles are expected to constitute around 30% of the total vehicle fleet by 2030.

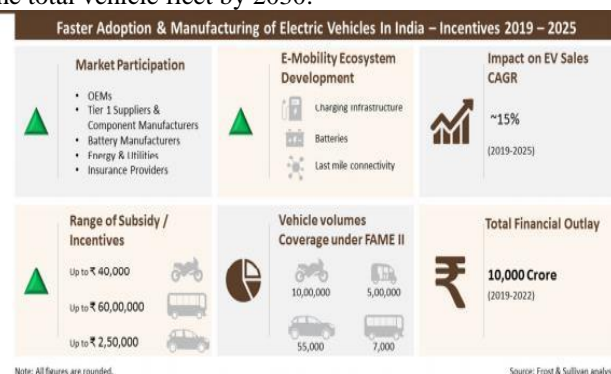


Figure 1: The FAME framework

### Literature Review

In the last couple of decades, there has been an increase in the volumes of electric vehicles being sold. Large number of studies has been carried out on this subject with respect to the consumers' perceptions and their motivational factors towards purchasing an electric vehicle, the impact that this adoption will have on the energy sector primarily the oil and gas market. Another important impact will be seen on the power market as the demand for electricity will also surge with conducive increase due to development and population expansion.

With the growing demand for electric vehicles, a number of studies have been conducted out in this regard to assess the impact of this growth on the energy sector primarily the oil and gas sector.

“The research by Yan et al (2019), based on the scenario of electric vehicles in China, makes an attempt to understand the Consumer's perception in terms of their Behavioural, Perceived, control, and behaviour attributes and analyses the key factors affecting consumers' purchase intention and actual purchasing behaviour. The paper is based on the Theory of Planned Behaviour (TPB) theoretical research framework and investigates potential consumers in typical urban and suburban areas of China like Beijing and does large amount of data collections through the means of electric questionnaires and surveys.” [2]

In a report by ICRA Limited (ICRA), the need for a paradigm shift from the conventional energy sources like oil, gas and fossil fuels to cleaner energy resources has been discussed with reference to the Paris Agreement, signed by 194 countries, that aims to limit the increase of the average of global temperatures to below two degree celsius.. The

report highlights that the growth for electric vehicles seems to be positive in the long term.

With the growing demand and sales for electric vehicles, another energy sector that will be impacted is the Power sector. The research by Albanese et al (2015) scrutinizes the outcome of the massive adoption of electric vehicles with respect to the power market. The research has been conducted from Italy's point of view but as per the researchers, the research is of relevance for the other industrialized nations as well. The study concludes that in the presence of photo voltaic generation, the benefits will be significantly amplified by initiating a program for the replacement of Internal Combustion Engine (ICE) Vehicles with Battery Electric Vehicles (BEV). Such a program would support the power demand and also help in increase the financial savings on the power production side.

"Hamilton (2018) [3] in their research study the consumer intention towards purchasing a green vehicle/ alternate fuel vehicle (AFV) in the South African markets. The study analyses the constructs from the theory of planned behaviour and researches the consumers' perception towards the electric vehicles in South Africa." [3] This research is of prime importance from the point of view of this paper as both South Africa and India are developing nations with some big issues on the social and economic front.

"The research by Henry Lee and Alex Clark (2018) [4] discusses about the challenges and opportunities for the adoption of electric vehicles. The research analyses the additional development and advancements needed to propagate the penetration of electric vehicles in the passenger vehicle fleet. The paper discusses the economics of commercial charging of electric vehicles and concludes it is dependent on a large number of factors and has the capacity of changing from location to location: missing of data with standardization on costs of capital, the charges on demand of electricity and the load data, and the existing and future uncertainties on the level of demand utilisation. The paper makes a discussion about the charging infrastructure available, the economics related to charging, the fixed costs and the variable costs involved in this. Load management for large scale electric vehicle integration has also been discussed in the research." [4]

"A report by the Bank of Canada authored by Étienne Latulippe and Kun Mo (2019) [5] Outlook for Electric Vehicles and Implications for the Oil Market analyses the implications and impact of adoption of electric vehicles on the world oil consumption. As per the analysis, they conclude that for every 100 million additional electric vehicles on the road in 2030, the consumption of gasoline will fall by about one billion barrels of oil per day and subsequently the oil prices will be lowered by 4%." [5]

As per a report by Niti Ayog, India has plenty to achieve from the earliest conversion of its ICE cars to EVs. The oil-import expense will decline dramatically. ICE cars are a significant contributor to urban emissions and their substitution by EVs would undoubtedly boost air quality. For limited and public electric cars there is a strong likelihood that we will become the masters. India has more than 170 million 2 wheelers. When we believe that each of such cars consumes just over half a liter of fuel every day or around 200 liters a year, the overall volume of fuel

consumed by these automobiles is around 34 billion litres. This would cost around ~2.4 lakh crores at about 70 per litre. Even if we believe that 50% of this is the expense of imported crude oil (as tax and other may be 50%), we can save about 1.2 lakh crores of imported oil. In the next five to seven years there is a real possibility to get this done. Nevertheless, this would require innovation, a policy regime that promotes access to the latest technologies, and Indian industry's concentrated effort to achieve global competition by acquiring the necessary size and using cutting-edge technology. [6]

From the literature review, it can be seen that the studies on the perception of consumers have been conducted with respect to specific countries like South Africa, Canada, USA etc. This study analyses the perception of Indian consumers towards the electric vehicles and from this analysis, deduces the impact that it might have on the oil and gas sector.

### Theory of Planned Behaviour:

"The theory of planned behaviour is developed from the theory of reasoned action, which is based on the theory of expectancy value, explaining individual decision-making process from the perspective of psychology". It is basically a theory that provides a link to one's belief system and their behaviours. "The theory states that an individual's behavioural intentions and behaviours are shaped by attitude, subject norms and perceived behavioural control. The theory predicts and understands human behaviour weighing the potential determinants' behaviour: behaviour intention is a process of accumulation and reinforcement of thought tendency and motivation. The stronger the intention is, the more likely the action. The individual's intention is jointly determined by the behaviour attitude, subjective norm, and perceived control behaviour as shown in below figure (Figure 1)". [7]

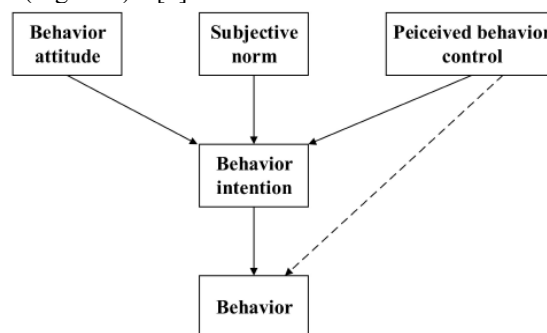


Figure2: Planned behaviour theory model

### Behaviour Attitude associated with Electric Cars:

"Behaviour attitudes represent potential consumers' assessment of the positive or negative impact of buying electric cars" [8]. The behavior towards electric cars depends essentially on whether respondents believe that electric cars are environmentally friendly or not, whether they are cost-effective or not, whether government policies support them or not, whether they will produce less noise than conventional passenger vehicles driven by electric cars. If a respondent believes in both of these considerations, they may have a favorable outlook toward the electric cars. The

pessimistic attitude would be strong if the respondents believe and understand that electric car charging is difficult and the infrastructure is not sufficient to support this, the speed of these vehicles is low and cannot meet daily needs or these vehicles require high maintenance and themselves have problems.

#### **Subjective Norm associated with Electric Cars:**

“Subjective norms represent the degree to which an individual perceives important people to expect an individual to perform a certain behaviour” [9]. Subjective norms basically express the level to which an individual might perform a particular action under some influence. It could be due to their friends, family, media, service providers, celebrities in some cases. In some nations, like in India, the Government also tends to influence the decision making by having certain policies or by providing subsidies which might compel the respondents to do that action.

#### **The Perceived behaviour control associated with Electric Cars:**

“Perceived behaviour control represents the individual’s perception of the difficulty of performing certain behaviour. It basically refers to the perception of people regarding their ability to perform a given behaviour. This is influenced by the resources and opportunities; the more resources and the opportunities an individual has, the stronger the perceived behaviour will be. When the customers feel that they the required money, they have the resources around them required to charge the electric cars and that they have the right to decide the purchase action of electric cars, then they might think it is busy to buy an electric car in future and have stronger control over the perceived behaviour of buying electric cars.” [7]

#### **Demographic and Socio-Economic Characteristics associated with Electric Cars:**

“The three main control demographic variables used in the model are gender, educational background and city. These variables affect the purchasing behaviour for electric vehicles.”(Qingyou, Guangyu, Meijuan, & Bowen, 2019)

#### **Designed Behavior Science Strengths:**

The proposed action hypothesis had the potential to examine people’s non-voluntary actions that cannot be justified by reason using the auction principle.

From numerous studies it has been determined that the planned behavior theory would be better able to predict health-related behavioral intention compared to reasoned action theory. Because of this principle of programmed behavior, the predictability of various health related fields such as sport , recreation, wellness has seen an increase. “The creation of social standard in both rational action theory and expected behavior theory allows for an understanding of the social actions of an person by including social norm as an significant element. An individual is not solely responsible for their behaviour, therefore the

behavioral intention of an individual cannot be the sole determining factor of behaviour, since the behavior control of an individual is not complete. Planned behavior theory should clarify this difference between behavioral purpose and real actions by incorporating the assumed influence mechanism.” [2]

#### **Limitations of the Theory of Planned Behaviour:**

The theory of planner behaviour has been criticized by some scholars because of their belief that the theory is based on cognitive processing. Cognitive processing refers to the number of asks being done by the brain continuously. It constitutes of the processes and procedures responsible for processing the information we receive from our environment.

“The theory has often been questioned because some researchers believe that the theory lacks an individual’s desires and expectations before participating in a specific activity, and that such conditions may often influence actions independent of attitude. An indication of that might be that a person may have a really good outlook about a sandwich but might not choose to eat because at the moment they are not feeling hungry. Therefore the action is often characterized by the individual’s need rather than just the attitude. An indication of a negative attitude may be that a person might have a very negative attitude towards alcohol and have very little desire to consume it. But in some cases, they may end up drinking because of them seeking a group membership or possibly when they are in a meeting and they end up drinking to fit in.” [2]

“The philosophy and its approach does not have a tool to measure the feelings of the individual at the moment of the interview or decision taking. Such feelings can be important to the model because emotion can influence the person’s values and other model constructs. Nonetheless, the low predictability of health-related activities in prior clinical studies appears to be attributed to the inadequate use of the model, the methodology and the interventions correlated with the model and the study.” [2].

The fundamental premise and assumption of the planned behavior theory is that behavior and intentions are nothing but the consequences of subjective norms, behavioral attitudes and perceived behavioral control. In a research by Sussman, Reuven (2019) [10], the above was demonstrated by an experiment. In their analysis, participants were challenged to shape the intention to join a particular environment-related entity such as signing a petition. After this intention was established, a change in perceived behavioral influence, social expectations and behavioral attitudes was found. Participants’ attitudes towards this institution were more likely to be favorable, and the participants were more inclined to expect more similar attitudes within their social community. The findings from this research indicate the links between three key elements — social norms, behavioral attitude, and perceived control of behaviour, and the intentions could be in either direction , i.e., bidirectional.

#### **Research Methodology:**



This research is based on the Indian respondents' awareness and perception, mostly constituted towards the electric vehicles in the metropolitan cities. The respondents' inclination to buy an electric vehicle in the near future would then be used to determine and analyze the future impact of the sample on oil consumption.

#### Data

The responses for the survey and analysis were captured using an electronic questionnaire. The survey questionnaire was distributed to respondents majorly from towns and cities in India. A Likert-scale having five points was used in the questionnaire : 1 , 2 , 3 , 4 , 5 represent “ Highly Disagree ” , “ Slightly Disagree ” , “ Neutral ” , “ Slightly Agree ” , “ Highly Agree ” A total of 150 valid questionnaire responses have been selected from the total of 154 responses received through the electronic survey. The quality of the questionnaire response was investigated with reference to the quality of responses (whether same answer marked in all questions); abstract answers were not given etc.

The results from the survey show that around 72% of the respondents were male and the remaining 28% respondents were female. The majority of the respondents have completed a Bachelor's Degree with the percentage being 72.5% and 23.5% had completed a Master's Degree. The remaining 3.9% accounts for high school or below. The survey found that the respondents were in the age group of 18 years to 60 years with the maximum number being in the 20 to 24 years of the age group followed by 25 years to 30 years of age.

Discussing about the advantages of electronic surveys for research data collection, this method is low cost and has a greater overall convenience. The respondents have the flexibility to answer the questions at their own pace and at a time they choose. This helps in increasing the response rate. Along with this, this method also provides the advantage of real time access whereby the answers are stored automatically and the results are available in no time. Surveys can also be designed and programmed so as to have intricate patterns to prevent skipping of questions. Moreover, answer choices can also be created as per convenience. The method eliminates the need for a reviewer and the respondents can also have the option to be anonymous.

Survey fraud is the biggest challenge for this method. If the survey is too long and/ or confusing, it might lead to fake responses. In this case, the chances of people just ticking the options for the sake of finishing of survey are high. In case of very complex surveys, it might even happen that the respondents won't respond.

#### Creation of theoretical structure and of hypothesis:

The following theories are developed, in conjunction with this Theory of Planned Behaviour: “H1: The more positive the consumers' attitude toward electric cars is, the stronger their purchase intention of electric cars and actual purchasing behaviour;

H2: The subjective norms of consumers are positively related to the purchase intention of electric cars, that is, the stronger their subjective norms are, the stronger their

willingness to purchase electric cars and actual purchasing behaviour;

H3 : The consumers' perceived behavioural control is positively related to the purchase intention of electric cars, that is, the stronger the perceived behavioural control is, the stronger their willingness to purchase electric cars and actual purchasing behaviour.” [2].

From the responses in the questionnaire, regression was used to forecast the growth of electric vehicles.

### Results and Analysis:

Reliability results for the variables: There were no instances of any data field not filled in the data set obtained. The analysis was done in SPSS and the Cronbach Alpha coefficients for behaviour attitude, subjective norm and perceived behavioural control were of the order 0.75, 0.7 and 0.71, respectively, which are higher than the acceptable value of 0.7.

#### Testing of the hypotheses:

A multiple regression model was developed to check the hypothesis of this study, and regression analysis was carried out. The multiple regression model was responsible for measuring the correlation between the intention to buy the electric vehicle and the behavioral attitude, subjective norm , and perceived behavioral control. The outcome of the regression model is shown in Table 1 with the beta-coefficients, the standard error obtained, the t-values obtained and the degree of significance.

Multiple regression analysis: Predicting intention to purchase AFVs					
Hypothesis	Path	$\beta$	t	p	Test result
H1	A-BI	0.61	11.62	0.00	Fail to reject
H2	SN-BI	0.26	4.95	0.00	Fail to reject
H3	PBC-BI	0.13	3.27	0.00	Fail to reject

**Table1:** Results from multiple regression analysisThe average regression coefficient for the regression model was found to be important after rendering the regression analysis in R program ( $R^2 = 0.81$ ,  $F(2.656) = 138.54$ ,  $p < 0.01$ ).

Through this the partial regression coefficients were discovered and the assumptions made above (H1 , H2, and H3) followed. In the H1 hypothesis, it was stated that the more favorable the attitude of the customer towards the electric car is, the greater would be their intention to buy and an actual action of buying an electric car. This was shown by ( $\beta = 0.61$ ,  $t = 11.62$ ,  $p < 0.01$ ).

In the hypothesis H2, “the subjective norms of consumers are positively related to the purchase intention of electric cars, that is, the stronger their subjective norms are, the stronger their willingness to purchase electric cars and actual purchasing behaviour.” [2] This has been shown by ( $\beta = 0.26$ ,  $t = 4.95$ ,  $p < 0.01$ ). In the hypothesis H3, “The consumers' perceived behavioural control is positively related to the purchase intention of electric cars, that is, the stronger the perceived behavioural control is, the stronger their willingness to purchase electric cars and actual purchasing behaviour.” [2] This proposition was supported ( $\beta = 0.13$ ,  $t = 3.27$ ,  $p < 0.01$ ).

The analysis was further done using R software to forecast the demand for electric vehicles. From the analysis it was found that the demand for electric vehicles is estimated to grow in the future and is also supported by the readings from articles and journals.

## Discussion

“This research attempted to identify those factors influencing consumer behavior towards India's electric vehicles and what impact it could have on the gasoline sector. It considered behavioral mood, subjective standard and perceived behavioral influence as variables that affect the intention to buy. The research found a significant positive relationship between the subjective norm and the intention to buy an electric vehicle, thus supporting the H2 hypothesis. This confirms that in addition to behavioral attitudes, consumers are also influenced by their social circles and environment to make a decision to buy an electric vehicle. The respondents usually perceived a strong societal expectation for purchasing electric vehicles. The importance of subjective standard in predicting the decision to buy an electric vehicle is attributed to at least two factors a individual is strongly affected by their atmosphere and surroundings. This especially holds true in the case of electric vehicles as the person might lack the knowledge or feel to lack the knowledge required to make an informed decision. This makes them rely more on their social circle of family, friends and sometimes influencers as well. They might take or rely on opinions given by the media as well. A vehicle being a tangible and a visible asset, a person can be concerned about their image related to driving and owning a vehicle. Because of this reason, a person might feel the need to comply with certain social norms and conduct on a certain manner as to what is perceived to be the right behaviour. [3]

Between the Perceived Behavioral Control and the purchase intention for electric vehicles, a significant positive relation was found. "This finding supports the H3 hypotheses: the perceived behavioral control of consumers is positively related to the intention of purchasing electric cars, that is, the stronger the perceived behavioral control, the stronger their willingness to buy electric cars and actual purchasing behaviour. It also indicates that the regulation variables usually influence the desire to purchase an electric car. Such considerations may include the electric car prices, the simple availability of the infrastructure needed and the charging facilities and the ease of use as compared to a conventional vehicles." [2]

Policies have a strong impact on EV adoption. The world's EV cities deliver initiatives such as guidelines for fuel economy and discounts for cars with zero to low emissions, and emphasis on charging infrastructure. An ambitious EV strategy can help create trust among private suppliers and productive systems will boost demand for EVs. The incorporation of charging infrastructure within the FAME framework is likely to provide momentum to the construction of public charging facilities throughout the country. It would see the introduction of charging stations in not just in Tier 1 cities but also in Tier 2 cities and highways. One of the most important issues for customers is

likely to be resolved – the country's dearth of charging facilities. The incentives and subsidies under FAME are expected to give a big boost to the production of new battery materials and chemicals. These policies will enable the manufacturers to manufacture electric vehicles at a lower cost. This would mean that the electric vehicles might see a surge in demand and more buyers in the market.

## Conclusion

This research was carried out primarily in India to know the impact of the consumer's perception of the electric vehicles on the country's oil and gas consumption. The research was carried out on the basis of the perceived conduct theory. According to this hypothesis, the behavioral disposition, social standard and perceived behavioral influence were factored in and examined their relationship and contribution to an electric vehicle's buying plan. As predicted, the study reveals that the positive attributes have a favorable and important effect on the actual buying behaviour while the negative attributes have a detrimental influence on the purchasing activity and it has an adverse affect. The drivers 'optimistic outlook towards electric cars was affected by these vehicles' reduced carbon levels, small maintenance costs and the government's discounts, programs and policies. This has increased the purchasing intention and also supported the actual buying behaviour for electric cars. Another aspect that has greatly influenced the decision to buy and therefore the real buying behaviour for electric vehicles is television ads, manufacturers' after-sales programs and an abundance of knowledge accessible to consumers on the internet. Thirdly, with a rise in disposable income, the provision of charging stations and the charging system, it contributes to good assumed behavioural influence by customers over the decision to buy an electric car. The detrimental characteristics impacting an electric car's purchasing purpose are that they have shorter battery capacity and reduced cruising speed relative to traditional cars and are locked at charging facilities. These factors diminish the intent of the consumer to buy an electric vehicle and also the actual purchase. A consumer is demotivated by these factors and may not buy an electric vehicle because of this.

From the analysis, it can be concluded that the massive penetration and adoption of electric vehicles has the potential to impact the oil and gas sector. The impact will be cumulative of the number of conventional gas and oil vehicles substituted by the electric vehicles and also by the average usage of the electric vehicles. Unlike the conventional gasoline engine vehicles, which can cover a larger distance per litre of oil, electric vehicles require frequent charging for covering the same distances. This is primarily due to the battery capacity of these vehicles. Hence, these vehicles might see a greater adoption and acceptance for short distance travels. Because of these factors, the growth of this segment will be largely propelled by the two wheeler and three wheeler vehicles, light motor vehicles (LMVs) and city buses. For long distance vehicles like trucks and UVs, further development is required in the battery capacity and technology and investment in the charging infrastructure. Because of the limited use of the

electric vehicles, it can be seen that the shift towards the adoption of electric vehicles might not have a very huge impact on the oil and gas demand. In fact, there might be some other cross cutting factors due to which the demand for oil and gas may increase. One is that with greater number of electric vehicles on the road the demand for electricity is also bound to increase. This would mean an increase is required in power generation. Since most of the power generation still comes from the conventional methods of using fossil fuels, gas and oil, it could be said that the massive adoption of electric vehicles might not impact the oil and gas industry to that extent due to this balancing factor. Increasing investment in the research and development of renewable and alternate sources of energy might impact the demand for oil and gas in the future. The shale gas exploration in the United States and increasing drilling and use of the Liquefied Natural Gas (LNG) would also impact the oil and gas industry. This industry, being dynamic and volatile in nature, sees high variations in prices and demand.

Talking about the Indian context with respect to electric vehicles, the country is expected to one of the fastest growing countries and has a huge consumer base for the adoption and usage of electric vehicles. This could attract the foreign players along with the domestic one like Mahindra to invest in the production of electric vehicles. The outcome of high adoption of electric vehicles, increase in demand of electric power supply and thereby an increase in the demand of oil and gas would determine the impact on this industry and also the demand. The demand for other refined items, like hydrocarbons, petrochemical products, crude oil might not be impacted that much as these are not directly used in the propulsion of engines. These are mainly required in the ancillary functions of the vehicles like maintenance etc and for the manufacturing of other commonly used items such as paraffin, wax, kerosene, petroleum jelly etc.

### Limitations

“Having obtained a greater number of responses would have made it possible to make the research more relevant in terms of drawing population inferences. With a larger sample size, better insight into individual behavior (by way of demographic-related variance tests) may also have been feasible.” [3].

The type of sampling used for this study is Convenience sampling. In convenience sampling, the data is collected by the researcher from a conveniently available pool of respondents. This sampling technique is the most commonly used technique as it's easy to use, prompt, and inexpensive and is not complicated. The collection of data is done as per researcher's convenience with respect to the respondents, the location of study, the demographics of respondents etc. The sample has been overrepresented by male respondents and was able to reach only those users who had access to internet. This somewhat limited the diversity in the responses received.

“The research made use of a self-administered questionnaire and, given the complexity of the measurement of some of

the constructs, may have impacted the internal reliability of the measurements.” [3].

Certain specific driving behaviours like the usage of electric vehicles as the main means of transportation could not be taken into consideration for the analysis.

The impact and influence of brands like Toyota, Tesla, and BMW on the actual purchasing behaviour could not be factored in for the analysis.

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