



Consumer's Attitude Towards Retrofitting of Existing Internal Combustion Engine Scooters with Electric Conversion Kit in India

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ABSTRACT

Increasing Pollution has made the World to find new sources of renewable energy. Electric vehicles are gaining momentum in this fanfare. As a result, Electric Conversion Kit has emerged as a new concept as a replacement to the traditional fuel-based vehicles. This paper projects the consumer's attitude relating to adoption of Electric Conversion Kits in their fuel-based vehicles in India. The present study is based on primary data which is collected from urban commuters. The paper highlights the consumer awareness as to the electric scooters, electric conversion kits for their fuel-based scooters and predict their willingness to switch towards e-mobility in future. Further, the paper brings a comparison between the consumers likeliness to adopt electric conversion kits over the purchase of an all-new electric scooter. The paper also depicts an analysis of future adoption of e-mobility based on the average daily run which may help in deciding the tentative battery size needed by the consumer to commute in a hazard free manner. The companies and government together need to spread awareness among the inhabitants about this concept and its likely benefits to environment as well as buyers in their lives. Also, there is a need to set a positive environment as to safety of these kits in order to fetch the public reliance.

1. INTRODUCTION

There are about 1,405,606,396 people living in India which makes it the second largest populous country in the world. The country is the largest producer of two wheelers in the world with an estimated fleet of 190 million two-wheelers in total. The two-wheelers industry itself accounts for more than 80% of the total automotive production in the country. The average annual domestic sales of two-wheelers between 2011-2020 accounted for 16.26 million units. Based on the average sales of the first quarter of the financial year 2021-22, the ICE scooters have around 25% share in the total two-wheelers sales in the country.

The Government of India has made a commitment to achieve the target of at least 30% EV by 2030 in the total vehicle fleet of the country. Further, at COP26, India targeted to achieve a net-zero emission in the country by 2070. This has geared up the business scope for

EV manufacturers and associated OEMs. The National as well as State policies regarding controlling of the vehicular emission deliver an ample of opportunities for the EV sector. Various companies are tussling up to capture the majority of market share. As a result of this, there are about 203 different models of electric scooters currently being offered for sale in the Indian market.

Amid of this, the researchers and market pioneers have developed a new concept of 'Electric Conversion Kit' through which one can convert their fuel-based vehicle into an EV and that too at a cheaper price than buying an all-new vehicle. Various existing firms and start-ups have taken it as their business opportunity and are working hard to manufacture the Electric Conversion Kit especially for two-wheeler segment. This sector has a huge readily available market needing a product that can cater to the needs of buyers who are facing various

difficulties such as harmful emissions, rising fuel prices, etc.

Various Chinese manufacturers are competing with Indian OEMs and have already developed their conversion kits which are available at cheaper prices and are being sold in the Indian market. The Government of India, in order to protect the domestic manufacturers and safeguard the lives of the potential consumers has mandated to fulfill certain standards to retrofit these kits into the conventional vehicles. The Electric Conversion Kit is needed to be based on the standards laid down under the Central Motor Vehicle Rules and it is needed to be approved by the concerned RTO.

For scooter segment many Indian players such as GoGoA1, motorkit.in, Starya, etc. are working hard to deliver the standardized kits and capture the potential market. Such companies are marketing their products through online as well as offline modes. Also, they are striving much harder due to a completely fresh concept of which the majority of Indian public is unaware. The average price of the kit ranges between INR 25k-35k as per the data analysed by the authors from various websites. Further, the battery cost depends on the range that a rider is expecting from its vehicle. For this, marketers are developing a subscription-based battery models in which the consumer has to subscribe for a battery pack and then it can swap the vehicle's battery from the swapping station whenever charging is required. This could help in saving the charging time and cater to city commuting for daily purposes at a reduced overall cost.

2. REVIEW OF LITERATURE

(Kumar, Reddy, Sudharshan, & Krishna, 2019) In their study, the authors have successfully fabricated their fuel-based two-wheeler with Electric propulsion system making it light weight and affordable design. The authors are of the opinion that this concept can lead in future if charging infrastructure is developed at a large scale throughout the country. The public can be encouraged to buy this technology through publicity, government

subsidies, appropriate warranty of the equipment of entire kit required to be installed into the scooter. The Indian OEMs and foreign investors with the support of Indian Government can make this concept a new business opportunity in the Indian market.

(Darekar, Gawande, Karkaria, & Karandikar, 2021) Under this study, the authors are of the opinion that the time has come to electrify our vehicles to safeguard the environment. They have converted Honda Scooter Activa 5G, Bajaj Pulsar Motor Cycle and a car named Maruti Suzuki Baleno into EV by retrofitting an Electric Conversion Kit in them after analysing the entire life cycle of these vehicles. It is found that recycling majority of parts and using them while converting them into EV will save energy as well as emission. The research recommends to retrofit existing scooters into EV between the age of 5-7 years from their purchase. For Motor Cycles and Cars this age is estimated to be 6-8 and 7-9 respectively. Overall, they are of the opinion that this can help in the improvisation of National scrappage policy by increasing the life of the vehicles and decreasing the pollution in the country.

(Kedar, Palkar, Maktedar, Sayyed, & Khatavkar, 2021) In this research, authors have retrofitted an electric conversion kit in a two-wheeler to ensure the electric mobility and as a result of this they are successful in achieving similar results which were projected before initiating the experiment. The vehicle is able to generate a range of 25 kilometers in a single charge using 48 Volt / 18 Ampere battery pack with a 1500-Watt Motor. Further, the authors were able to charge the battery in just INR 5.2 which means that the vehicle can run about 4.8 kilometers at a cost of one rupee only. This is extremely cheap.

(Harris, et al., 2021) According to this research, it is economical to convert an ICE based scooter into an electric scooter. The fabrication cost accounted to INR 13,200 only which is equivalent to 17% of the total cost of similar new vehicle when second hand components were used. The authors are able to achieve a top speed of 30 kmph. As the charging

level decreases, the top speed of the scooter also decreases and goes less than a speed of 25 kmph at a charging level below 40% of the total. (Vasanthaseelan, Dharun, Sreerag, & Gokul, 2019) In this research, the authors converted a two-wheeler into an EV using a 600-watt traction motor and a battery pack of 48 volt and 10 Ampere of current. The vehicle produced a top-speed of 25 kmph and a range of about 25-30 kilometers per charge. The authors are of the opinion that this technology has a bright future only if we can deliver products which can generate similar power and a good torque that an ICE vehicle produces.

(Akodiyawala, et al., 2020) Under this research, Honda Dio scooter is converted into an electric scooter in which 800-Watt motor and 24 Ampere Battery Pack is used with 48 Volt power. As a result, the scooter successfully ran on electrical energy and produced a top speed of 45 kmph with 60 kilometers of range at a single charge. The overall comfort was found to be satisfactory. It costed around INR 9.88 to fully charge the battery pack which means one can travel around 6 kilometers at a cost of single rupee. The authors recommend this concept as it is economical and emission free.

3. RESEARCH PROBLEM

The stringent targets to control pollution and maintaining the earth's temperature has compelled every nation to shift from traditional sources to renewable sources of energy. As a part of this, the automobile sector is facing a challenge to convert their entire production structure and to build emission free vehicles ensuring sustainability. Almost all the companies associated with automobile industry, especially OEMs, are building up their strategies and struggling to manufacture products that can cater to the needs of society with the available resources and technology. As a result, many companies are engaged in the development of 'Electric Conversion Kits' to convert the fuel-based vehicles into EVs.

Consumer is said to be the king pin of the market. Mere development of a product is not satisfactory, but there is a need to understand whether the potential buyers in the

market are going to adopt it or not. In this paper, we are going to predict the consumers attitude towards the adoption of Electric Conversion Kits in scooter segment. We are going to predict the consumer's preference as to adoption of Electric Conversion Kit over new electric scooters and conventional petrol scooters.

4. RESEARCH QUESTION

Mere development of a technology is not sufficient, its adoption and usage among the society decides its importance. In this research, we will find out the consumers attitude towards the adoption of electric conversion kits in conventional scooters.

5. RESEARCH HYPOTHESES

This research has the following hypothesis:

H₁¹: The Consumers are aware of the Electric Conversion Kits.

H₁²: All Consumers will adopt the Electric Conversion Kits over the decision to purchase a new electric scooter or petrol scooter.

6. RESEARCH METHODOLOGY

This research is based on the primary data which is collected from Indian consumers who are using conventional two-wheelers based on fuel in the urban areas of India. The data is collected through a survey conducted in the form of questionnaire. The sample size is determined based on Cochran's formula, the calculation of it can be seen below:

$$n = \frac{(z^2 * p * q)}{(e * e)} = \frac{(1.96^2 * 0.5 * 0.5)}{(0.5 * 0.5)} = 384.1$$

where, n = Sample Size

z = z-value in the Z table which comes out to be 1.96

p = population proportion which is assumed to be 50%

q = 1-p

e = margin of error which is assumed to be 5%.

The authors approached to around 500 users of two-wheelers of which 436 responses were recorded for the purpose of analysis and rest did not respond to the questionnaire. The survey included questions relating to the

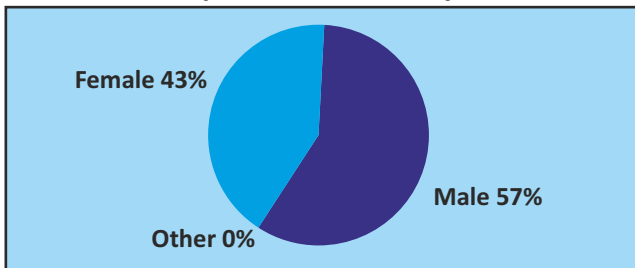
average km-run of consumers on daily basis, current scooter owned, their awareness level as to availability of e-scooters and the electric conversion kits. Furthermore, the consumers were asked to give their preference among the adoption of electric conversion kit for their existing vehicle, buying a new e-scooter or a new petrol scooter.

7. QUESTIONNAIRE ANALYSIS

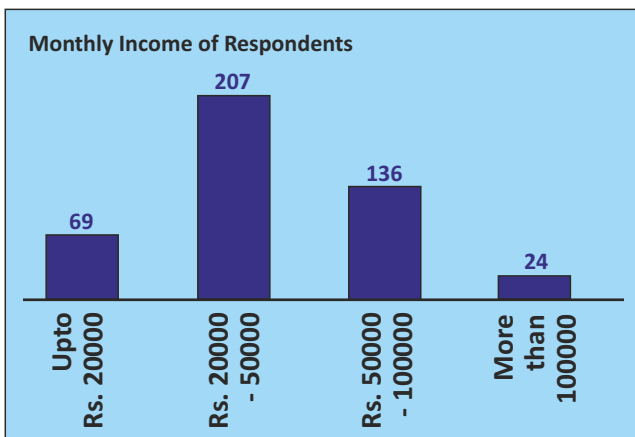
7.1 Gender Analysis

There were 436 participants in the survey of which 250 were male, 185 were female and 1 belongs to other category.

Graph 1: Gender Analysis



Graph 2: Monthly Income of Respondents



7.2 Monthly Income of Respondents

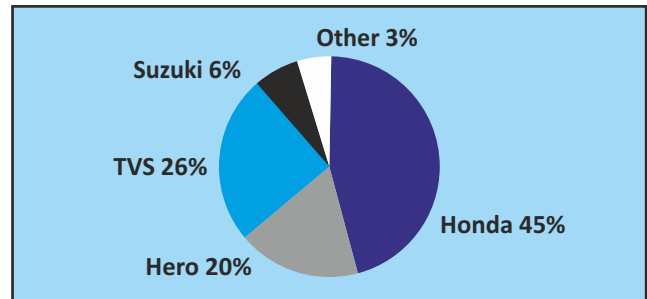
The monthly income of the consumers is asked and the data so collected has been compiled and presented in the Graph 2. According to the data so collected, it is found that 69 respondents earn upto Rs. 20,000; 207 earn between 20,000 and 50,000; 136 earn more than Rs. 50,000 but upto Rs. 1,00,000; 24 earn more than Rs. 1,00,000 on a monthly basis.

7.3 The Scooter Which Respondents are Using at Present

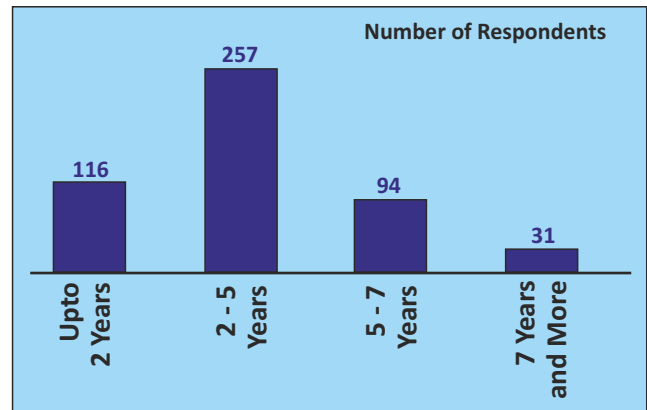
The data has been compiled and presented company-wise. In the survey we

found that 198, 86, 112, 28 respondents were using Honda, Hero, TVS, Suzuki scooters and rest 12 respondents were using the scooters of other brands. (Graph 3)

Graph 3: Scooter Owned by Respondents



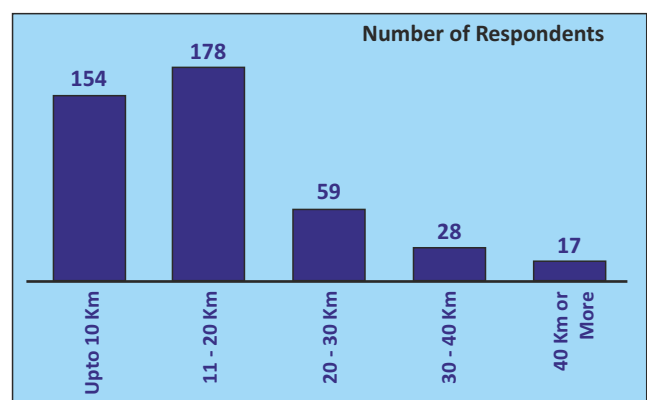
Graph 4: Time Duration of Existing Scooter



7.4 Time Duration For Which Respondents are Using This Scooter

On analysis, it is found that 166 respondents were using their scooters from few months but upto 2 years. 257 respondents were using their scooters for more than two years but upto 5 years. 94 of them were using their scooters for more than 5 years but upto 7 years. There were 31 respondents who were using their scooter for more than 7 years.

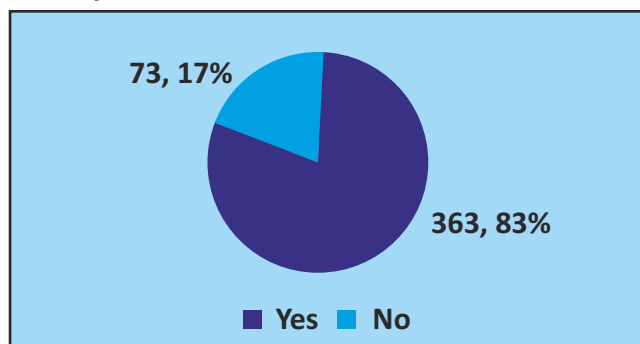
Graph 5: Daily Run



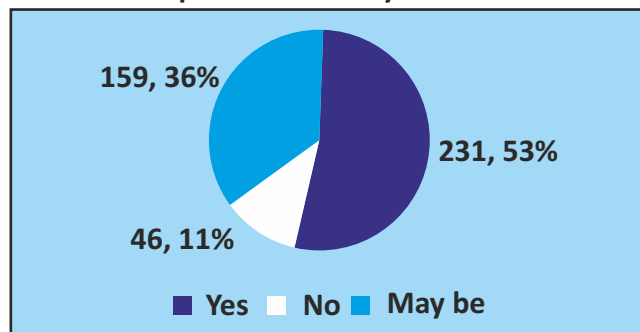
7.5 Average km Run on Daily Basis

Majority of respondents travel upto 20 kilometers on a daily basis. The percentage of these commuters is more than ¾ of the total. Please see graph 5.

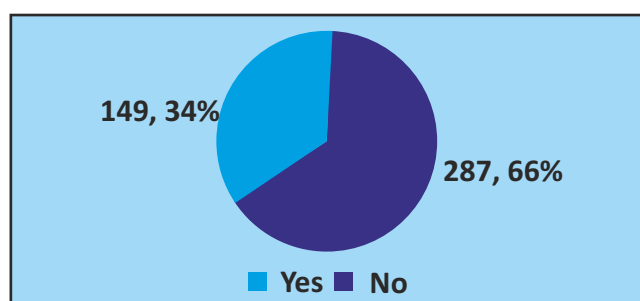
Graph 6: Awareness about Electric Scooter



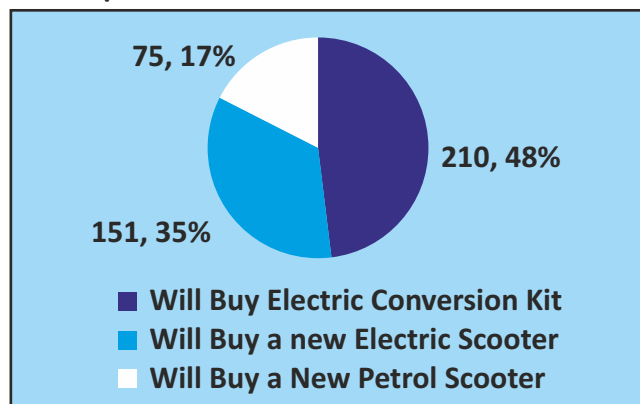
Graph 7: E- Mobility in Future



Graph 8: Awareness about Electric Conversion Kit



Graph 9 : Future Preference of Consumer



7.6 Awareness About Electric Scooters

On analysis of the responses, it is found that 363 respondents have heard about the electric scooters and were aware of it whereas 73 respondents did not hear about this technology at all.

7.7 Consumer Willingness to Adopt E-Mobility in Future

231 Respondents are sure of adopting EVs in future for their daily commuting. This decision forms a majority. About 36% respondents are not sure about their future vehicle usage. It may be concluded that they would decide their preference at the time of changing their vehicle. Around 46 respondents which accounts for 11% population does not want to switch towards electric mobility.

7.8 Consumer's Awareness about the Electric Conversion Kit

After analysing the responses, it was found that around 66% of the population is not aware of the concept of 'Electric Conversion Kit' whereas 34% knew about this concept. It means the majority of public does not know anything about this technology.

Conversion Kits are available at a price much cheaper than new electric scooters. The respondents were asked to prefer their choice as to future mobility options.

7.9 Future Preference of Consumers

Majority of respondents being 210 in numbers likes the concept of Electric Conversion Kit and showed their interest to buy them to retrofit in their existing scooters. The respondents who choose to buy an all-new electric scooter accounted for 151 in numbers that represents 35% of total population. 17% of the total wants to buy a conventional fuel-based scooter again in future.

8. TESTING OF HYPOTHESES AND RESULTS

Based on the data collected through Questionnaire, the hypothesis can be tested to arrive at conclusion.

Hypothesis 1 - The Consumers are aware of the Electric Conversion Kits.

Result - It is found in survey that around 66% of the population is not aware of the technology of electric conversion kits. Thus, it can be said that

the hypothesis is rejected.

Hypothesis 2 - All the consumers will choose to adopt the Electric Conversion Kits over the decision of purchasing a new electric or petrol scooter.

Result - As the data collected from consumers shows that only 48% of the respondents are likely to adopt the electric conversion kits for their existing scooters in the future. Therefore, it can be said that the above hypothesis gets rejected. 35% of the population will make a decision to purchase an all-new electric vehicle whereas 17% of the population does not want to adopt for e-mobility at all.

9. CONCLUSION

After detailed analysis and interpretation of the data collected, it can be concluded that the concept of Electric Conversion Kit has an

appealing business opportunity for many, if more refinement is done in technology and products are developed keeping in mind the Indian roads and climatic conditions. The electric conversion kits are economical. This factor in its own has a marketing advantage. The companies engaged in the production of these kits needs to get the ARAI and RTO approval based on the Central Motor Vehicle Rules. Further, the companies and government together need to spread awareness among the inhabitants about this concept and its likely benefits to environment as well as buyers in their lives. Also, there is a need to set a positive environment as to safety of these kits in order to fetch the public reliance. The popularity and increased awareness level will definitely have a positive impact on the sales of electric conversion kits. ●

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