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**Project Dissertation Report on**

**“Consumer Perception of EV in India”**

**Submitted by**

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## **Executive Summary**

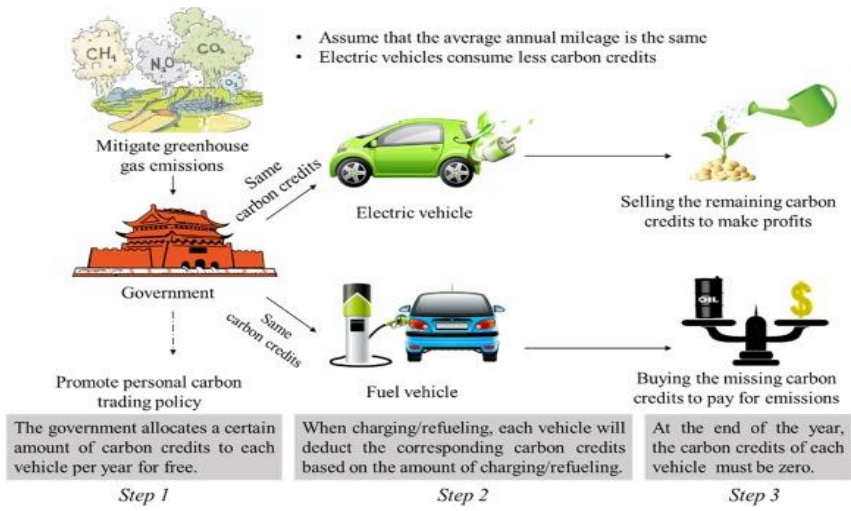
With current research, dwindling fossil fuels supplies and rising prices, an alternative source of energy to power motor vehicle is urgently required. Auto industry sectors are leading the charge in the field of electrical vehicles, which they see as a long-term answer for both the auto industry & the environment in India.

EV presence in on Indian roadways is quite minimal in the current market context, despite the fact that the Indian government is enacting EV laws. The main rationale for the Indian government's support for the EV policy is that electrical vehicles reduce reliance on oil, reduce greenhouse gas emission, and improve air quality. The biggest contaminant has been identified as coming from metropolitan areas. As a result, it is critical that residents of these cities recognise the importance of doing their part to minimise the consumption of life-threatening gases and pollutants.

The goal of this study was to look at “Consumer perception of Electrical Vehicles in India.” Despite the fact that research in this subject is progressively gathering up steam, it remains one of India's most overlooked segments.

15

## Consumer preferences for battery electric vehicles: A choice experimental survey

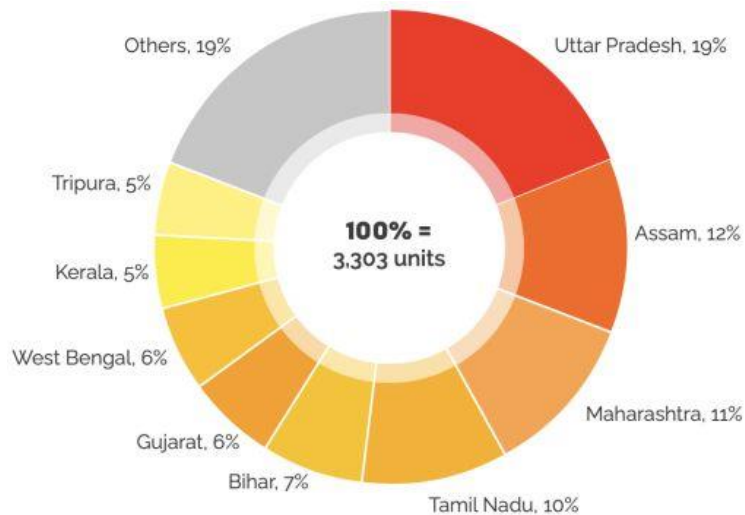


Source [www.sciencedirect.com/science/article](http://www.sciencedirect.com/science/article)

## Introduction

The rise of air pollution in Indian locales has been a source of concern as the country has evolved and prospered economically. The majority of locations have had negative environmental impacts. The construction boom in big cities will exacerbate dust pollution. 'Dirty' sources of electricity, such as coal-fired power plants, have a higher demand for electricity. Economic expansion tends to boost the adoption of private vehicles as emissions and their impact on air quality rise. The adoption of electrical vehicles in India is depicted in the graph below.

### State-wise adoption in electric vehicles



<https://e-vehicleinfo.com/wp-content/uploads/2022/01/image2.jpg>

Supporting the transition to electrical vehicles is one of the most significant areas that the national and state governments in India place a high premium on.

The Indian Government began to employ budgetary policies such as follows...

1. To discourage the purchase and usages of more polluting vehicles, a road charge will be imposed.
2. After 15 years of use, a green fee is applied when the vehicle is re-registered. This is to encourage individuals to abandon polluting vehicles in favour of less polluting, fuel-efficient vehicles, and so on.
3. Through the national FAME<sup>17</sup> (Faster Adoption and manufacturing of Hybrid & Electrical vehicles) programmes and state-level equivalents under the set targets, the Indian government has shown a strong commitment growing the EV sector and lowering vehicle carbon intensity. In the future, more companies will have a lot to offer in this field, whether it's new battery technology or management systems for managing EV fleets-electrical micro-mobility solutions.

### **What is the definition of Consumer Perception?**

It is to "Showcase the idea that envelops a consumer's impression, mindfulness, or cognizance about an organization or its all contributions." To improve thought of the item which the consumer requires needs, they gather various wellsprings of data on a specific part of an item, which is referred to as Consumer Perception.

Currently the consumer will make a purchase decision based on several advertisements, surveys, technological advancements, and inputs from online life. When a customer investigates or views an item's data. the procedure for client perception begins. This procedure continues until the customer is satisfied or pleased with the product. It has been observed that whenever a company makes changes to an item, it has negative impact on the client perception. The things should be based on the logo's colors and states, the best notices that are carefully constructed by retailers, and the constraints that it gives will have an impact on consumer perception.

We will give an overview of present & predicated growth trajectories for many elements of the EV ecosystem, ranging from electric bikes to vehicle components charging infrastructure, through this project.



## Calculating Electric Vehicles “Well-to-Wheel Efficiency”

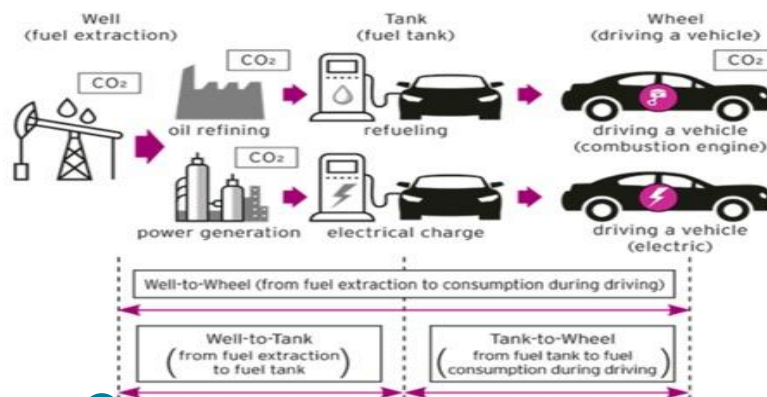
The usual truth of discussion is that national grid power is generated using a range of non- CO2 emitting technologies such as wind, hydro, geothermal, nuclear, solar, and so on.

Some deliberation below gives idea about electrical vehicles, even when driven beside energy provided by coal-fired power plants, are far more effective and efficient than oil-fueled vehicles, resulting in lower CO2 emissions.

We utilized a few examples in which we computed “well-to-wheel” efficiency and compared the findings with reference to competency and CO2 emissions.

### 7 Conceptual illustration of Well-to-Wheel analyses for efficiency and

#### CO<sub>2</sub> emissions



7 Source: [https://kleebinder.net/wp-content/uploads/2019/11/figure\\_1.1\\_study\\_AU.jpg](https://kleebinder.net/wp-content/uploads/2019/11/figure_1.1_study_AU.jpg)

**6 Small Electric Car is 2.5 times more efficient than small petrol car**

**A) Small Indian petrol car's "Well-to-Wheel efficiency"**

1) Per liter 34.3 Megajoule of petrol (Calorific value) is equivalent to 9.5 kWh.... (A)

2) **5** Refinement & transportation losses (about 33% in India) \* km/liter..... (B)

The efficiency of a regular petrol car providing 15 km/liter is:

$$= (A) - (B)$$

$$= 1 / (34.3 / (100 - 33) \text{ percent}) \times 15 \text{ km/liter}$$

$$= 0.29 \text{ km/ Megajoule equal to } 0.29 \text{ km/277 Wh}$$

3) **5** It can be seen from the foregoing that the small petrol-car must expend 3.45 MJ or 955 Wh of energy to travel of 1.0 km.

**B) Small Indian electrical car's "Well-to-Wheel efficiency"**

1) According to a study based on data from the market electrical car, we discovered that an electrical car on Indian roads consumes power 90 Wh/km on average.

As we know: Wh = 3600 J therefore 90Wh is equal to 324,000 J

2) In India, the efficiency, conversion, & transmission losses in grid electricity of power plant are at least 70%. As a result, 90 Wh/Km electrical car from

India has been developed. Now Efficiency of such cars

$$= \frac{1}{3600} \div (100 - 70) \text{ percent} \times 10^6 \times (1/90) \text{ km/Wh} = 0.93 \text{ km/ Megajoule}$$

Now,

$$= \text{Efficiency} * \text{Car battery efficiency (full cycle charge and discharge)}$$

Assume that the small EV battery factor as 80 percent.

$$\text{Final efficiency} = 0.93 \times 80 \text{ percent} = 0.74 \text{ km/MJ}$$

$$\text{or } 0.74 \text{ km} / 277 \text{ Wh}$$

- 3) It can be seen from the foregoing that a small car requires consume 1.35 Megajoule or 375 Wh of energy to drive 1 .0 km.

### C) Conclusion

For one kilometer, an electrical car requires 375 Wh of energy, while a gasoline car requires 955Wh. As a result, a small electrical automobile is 2.5 More times more efficient than a comparable gasoline vehicle the equivalent petrol car.

Similarly,

- **Electric SUVs are 1.8 times more efficient than a diesel SUV**
- **Electric Scooters are twice more efficient than a petrol scooter**

### **Assumptions:**

T&D losses are included in the efficiency of a power plant. The loose substitution of loss for both generating and transmission or distribution loss is about. “70 Percent” is a phrase that can be used to describe a group of people.

The following has been discovered:

- Electrical generation from coal efficiency is 33 percent (i.e., Generation efficiency), lowest among the power producing countries which are majorly in the coal –based production. Because not all fuel is coal, the overall fuel to power generation ratio is **40%**.
- T&D losses in India are estimated to be 27 percent, according to the World Resources Institute (WRI). The highest on the planet.

In India, 40 percent \* (1-27 percent) = 29.2 units of power are provided and produced (from 100 units of fuel). As a result, the overall loss is 100 - 29.2 = **70.8 percent**, which is roughly the same as the loose substitute.

## CO2 Emissions

Coal has 23.8 grammes<sup>6</sup> while Oil has 19.9 grammes of carbon/mega joule. Calculating vehicle efficiency using these carbon content levels in the pointers below. For every kilometer driven,

- Carbon footprint of a small petrol automobile  
= 68.66 g/km (i.e., 3.45 mega joules/km x 19.9 g/mega joules)
- Electric vehicle has a low carbon impact  
= 32.13 g/km (i. e.; 1.35 mega joule/km x 23.8 g/mega joule)
- Total amount of greenhouse gases (CO<sub>2</sub> + CH<sub>3</sub>) of a SUV-Diesel car  
= 117.01 g/km (i.e., 5.88 mega joule/km x 19.9 g/mega joule)
- Total amount of greenhouse gases (CO<sub>2</sub> + CH<sub>3</sub>) of an Electric SUV  
= 74.25 g/km (i.e., 3.12 mega joules/km x 23.8 g/mega joules)
- Total amount of greenhouse gases (CO<sub>2</sub> + CH<sub>3</sub>) of a petrol scooter  
= 20.47 g/km (i.e., 1.03 mega joule/km x 19.9 g/mega joule)
- Total amount of greenhouse gases (CO<sub>2</sub> + CH<sub>3</sub>) of an Electric scooter = 10.47 g/km (i.e., 0.44 mega joule/km x 23.8 g/mega joule)

We consumers assumes that all the generated electricity from coal but this scenario is not correct. Some of the electricity generates from several supplementary sources also which have a zero/lighter carbon footprint. For example, we consider the process of car manufacturing and subtracting the availed electricity in making of petrol cars & refining oil, EV will subsequently win out.

Coal's higher CO<sub>2</sub> content are equalized by the solar, hydropower, wind energy, geothermal, nuclear power, and so on negligible CO<sub>2</sub> content. Power production is a mixture of demand diverges from one small part of the India to other part of the India and it is continuously change with time. As a consumer consider that, Electrical Vehicle gets even greener and efficient over long run time.

## **Importance of Consumer Perception**

A recognized customer is the who gets affected by the circumstances that he or she have with a particular product just as administrator. The beginning of a consumer's encounter with an item is his or her perception of it. The decision to choose or reject a brand is solely based on the consumer's impression. When a customer believes that their appealing things are delivered on time, they will, in general, form an opinion. The item's vivid portrayal can contribute to a positive element of the consumer's perception. When a customer is pleased with the services provided by a company after purchasing an item, the customer develops a positive impression of the brand. On the other hand, if a customer has a bad evaluation/experience, such as damaged things, no profits, and so on, the customer will have an unfavorable view of the brand in general.

When organizations/brands strive to move or focus in the direction of strengthening and sustaining the relationship between customers and the organization, consumer perception improves steadily and provides an extreme superior peripheral. Consumer impression is one of the most important factors to consider when deciding what kind of image, a company should project. For

example, at a tea/coffee house, the cups that are placed in various racks; if the nature of those cups is inadequate, the consumer perceives the organization/brand to be of lower quality.



However, when the marketing trick is masterminded and the cups are held under the lights to attract customers with high quality, the customer develops a different opinion of the company/brand. Client purchase behavior is heavily influenced by the consumer perception. As a result, organizations/brands adapt to provide a positive and easy client experience.



## Consumer Perception Influencing Factors

External factors, some of which are described below, can influence consumer perception:



### 1. Personal Experience

The personalized experience that a customer had while purchasing a certain item has a significant impact on consumer perception. With quality, client assistance, value, logo, shading, boundaries, and so on, there is a little chance that a brand/organization can build a brilliant connection with the ‘customers’ psyches. They would form a favorable impression of the brand.

## **2. Promoting**

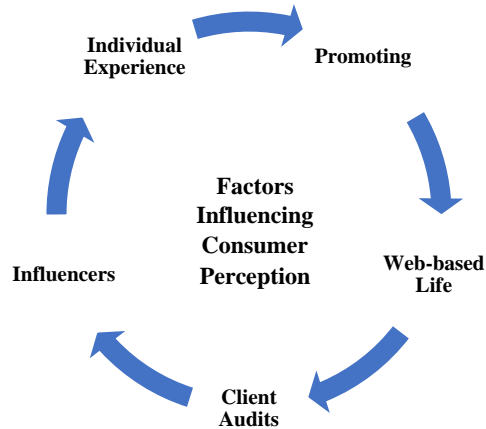
The majority of the time, consumers are given the opportunity to see the things first through promotions. As a result, it has become the most important factor influencing consumer impression.

The publicity and crusades that a company performs will help to create a favorable consumer perception.

## **3. Life on Internet**

Nowadays, the most reliable channel for monitoring consumer sentiment is the internet. Clients gather an image of the thing when the internet-based life population gets a dependable resemblance in regard to the product. Internet life can be used to upload content, photographs, and recordings, which helps the organization/brands construct the perception they want.

## External factors can influence consumer perception



### 4. Audits of Clients

Before buying something, a large number of people look into consumer surveys. This demonstrates that client audits have an important role in determining consumer perception. There is a chance that if a customer sees that an item has a lower number of stars, it means that the item has poor customer reviews. It leaves a negative impression on the consumer persona.

## **5. Influencers**

The majority of purchase are made after someone else has tried and tested the goods. Influencers are those who have first-hand knowledge of a product and have tried it. When people hear about a fantastic product that an influencer has tested and tried, they are more likely to want to acquire it and try it out because the requirement came from someone they know and trust.

### **Objective**

The goal of this research is to understand buyer perception and key determinants in the purchase of electric vehicles in India.

### **Customer:**

- What is the demographic profile of today's Electric Vehicle?
- Which characteristics of demographic most impact influences Electric Vehicle ownership and behavior?

### **E-vehicle of Choice:**

- Is the buyer interested in an electric bicycle, an electric bike, an electric scooter, or an electric car?

### **Recharging of an electric vehicle:**

- How often do electric vehicle owners charge their vehicles?
- Where do consumers get their Vehicle charged?
- When and where do consumers charge their electric vehicles?

## **Review of Literature**

1. Solar Power + Electric Vehicle Charging (Great Plains Institute, 2020)

The project provides a summary of Solar + EV research, as well as aggregated findings and other stakeholder feedback from current regulatory and programme initiatives. Some of the important conclusions include the need to better understand the economic potential of Solar + EV applications, the need of achieving daytime EV charging, and the need to better understand the distribution system impacts and costs.

2. Effects of product user stereotype and self-image congruence (Roger Bennet, 2018)

The impact of the buyer pleasure on associations between buyers' mental self-portrait harmony in relation to buyers of a naturally beneficent commodity is investigated in this experiment (electric vehicles [EVs])

3. Consumer attitude about electric cars pricing analysis and implementation (Larson, 2014)

A consumer attitude survey was conducted, and results were examined. Individuals that used the automobile preferred to purchase high-priced autos in the future.

### Domestic Automobile Sales Trends

Category	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
<b>Vehicles for Passengers</b>	2789208	3047582	3288581	3377389	2773519	2711457
<b>Commercial Automobiles</b>	685704	714082	856916	1007311	717593	568559
<b>Three-Wheeled Vehicles</b>	538208	511879	635698	701005	637065	216197
<b>Two-Wheeled Vehicles</b>	16455851	17589738	20200117	21179847	17416432	15119387
<b>Combined Total</b>	<b>20468971</b>	<b>21863281</b>	<b>24981312</b>	<b>26265552</b>	<b>21544609</b>	<b>18615600</b>

Table -1 (Domestic Automobile Sales)

**Source:**

<sup>13</sup>  
<https://www.siam.in/statistics.aspx?mpgid=8&pgidtrail=14>

Domestic sales (excluding exports) grew at a pace of 1.2 percent between FY 2015 and FY20, according to the above table-1, with 21.6 million vehicles sold in FY20. Two-wheelers accounted for 80 percent of the sales, while four wheelers, including passenger and commercial vehicles, accounted for 16 percent.

<sup>18</sup>  
 In terms of production, India is the world's IVth largest manufacturer of passenger automobiles and the VIIth largest manufacturer of commercial vehicles as of 2019.

Between FY2016 and FY2020, domestic production increased by 2.4 percent, with 26.4 million automobiles produced in FY2020 (IBEF, 2020). In India, transportation is a major source of pollution, and many cities experience severe traffic congestion during rush hours. In Indian cities, the typical peak-hour travel speed is 15 to 20 km/h (Verma et al. 2015).



## Methodology of Study

### 1. Design of the Study

- Descriptive survey research will be used for both secondary research and primary research.

### 2. Sources of Information

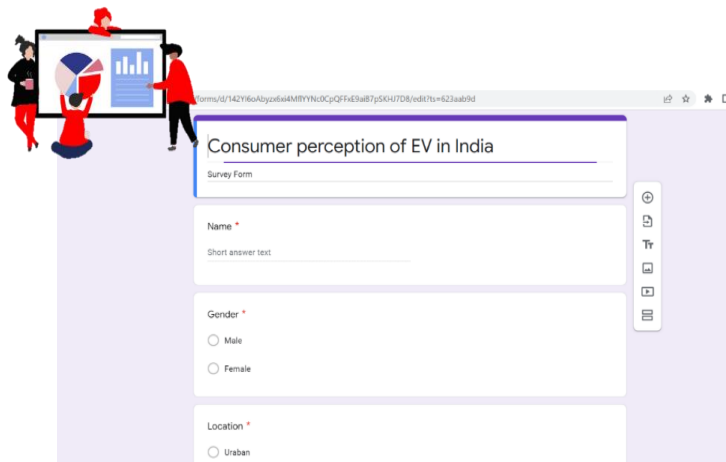
- Google scholar, Google websites, government sites, company sites, magazines, textbooks, newspapers, and other secondary data sources
- By reaching target consumers, a primary survey was conducted via an online digital survey using a Google form

### 3. Method of Data Collection

- Primary survey method

### 4. Population

- Total number of responses received are 71



## Data Analysis and Interpretation

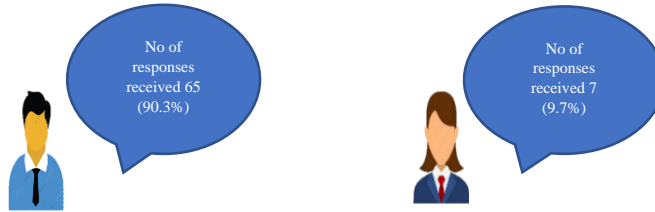
The questions and specific responses received from the questionnaire are listed in the below table:

S.No	Questions	Responses
1	Gender	90.1% of the responses are male and 9.9% are female
2	Location	Mostly of our responses are from urban areas which is 91.5%
3	Occupation	80.3% of responses are employees in an organization followed by 12.7% owns a business
4	Income Slab	45.1% of people have the income slab of INR 10 Lakh – INR 50 Lakh followed by 12.7 % of people has more than INR 50 Lakh income
5	Do you own any E-Vehicle?	Till now 85.9% of the responses does not own any E-Vehicle. Only 14.1% of the people owns it
6	If you want to change/buy your vehicle, which type of vehicle would you prefer?	54.9% people wants to buy Hybrid Vehicle (Electrical & Petrol), followed by 32.4% responses wants to buy EV
7	How much should be the cost of electrical vehicle in the Indian market	40.8% of responses are think that the 5 – 10 Lacs is the economical price to buy an EV
8	Which type of E-Vehicle would you prefer?	Electric car is the most preferred option for the responses with the 73.2%
9	Which brand/company would you prefer to buy your EV?	M/s TATA is the most preferred EV to buy with 46.5%
10	Do you think it is too early to say for electric cars that they are not reliable enough?	53.5% responses think that currently it's too early to say that EV are reliable enough

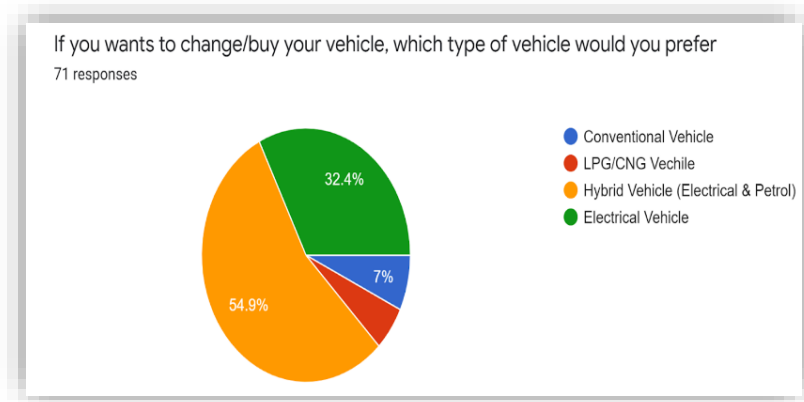
11	Which Factors influences you to buy EV?	Positive Environmental effect influences 38% consumer responses to buy an EV
12	Is EV can protect from the global warming?	38% consumers agree that EV can be considered in protecting the global warming
13	What changes would you prefer in your EV?	22.5% of consumers need to change the travel efficiency of their EV while 22.5% of responses have yet not tried any EV
14	Do you know about the subsidies provided by the Indian government on purchase of EV in the future?	53.5% consumers are aware about the subsidies provided by the Indian government on purchase of EV in the future
15	What could be the drawbacks/limitations to consider the EV's?	33.8% consumer thinks that re-charging is the drawback /limitation while considering the EV
16	Would you like to consider buying EV in next two years?	60.6% consumer agrees to buy EV in next two years while 28.2% consumers may buy the same
17	Do you think EV is worth taking for the long routes?	Approx. more than half of the consumers i.e.; 50.7% thinks that EV is not worth taking for longer routes
18	If you own an EV, what will be your charging preferences?	56.3% consumers preferred to have home/apartment (overnight charging) for their EV

Table -2 (Data Analysis based on survey)

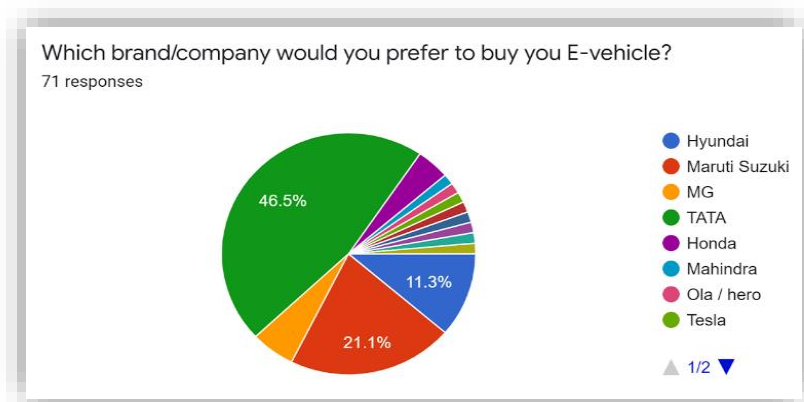
1. 90.1% of the responses are male and 9.9% are female



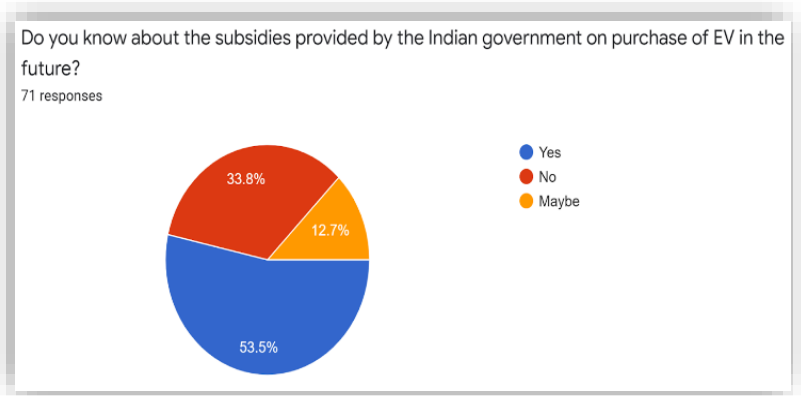
2. 54.9% people wants to buy Hybrid Vehicle (Electrical & Petrol), followed by 32.4% responses wants to buy EV



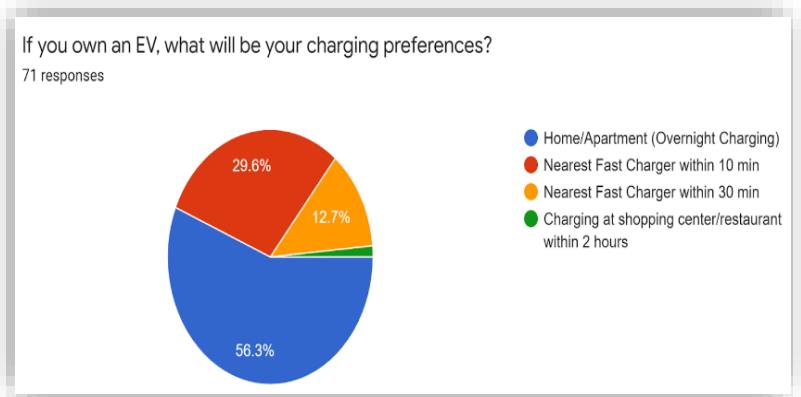
3. M/s TATA is the most preferred EV to buy with 46.5%



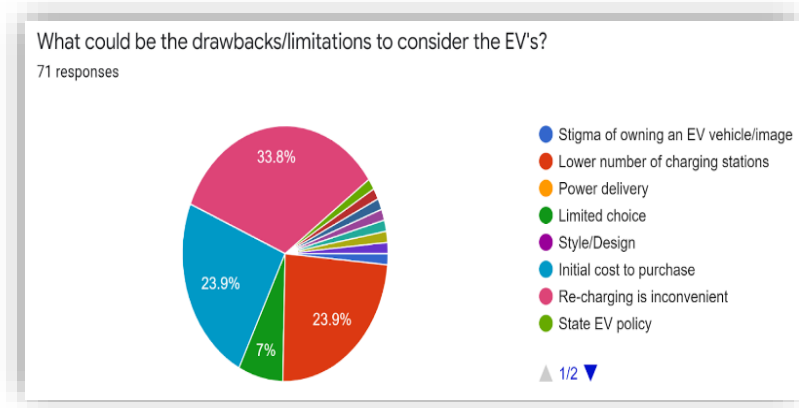
4. 53.5% consumers are aware about the subsidies provided by the Indian government on purchase of EV in the future



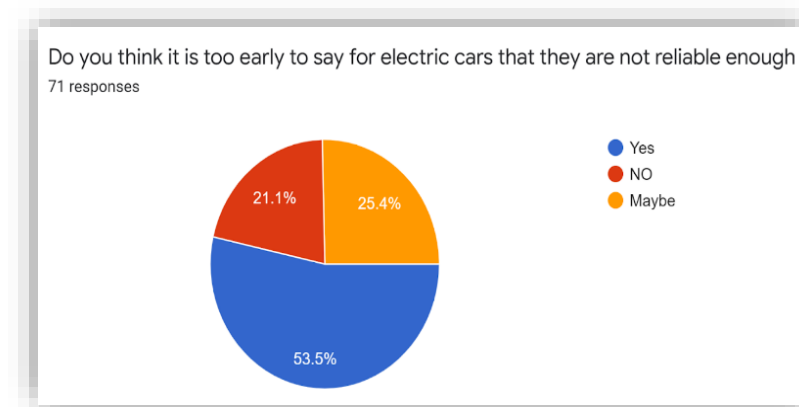
5. 56.3% consumers preferred to have home /apartment (Overnight charging) for their EV



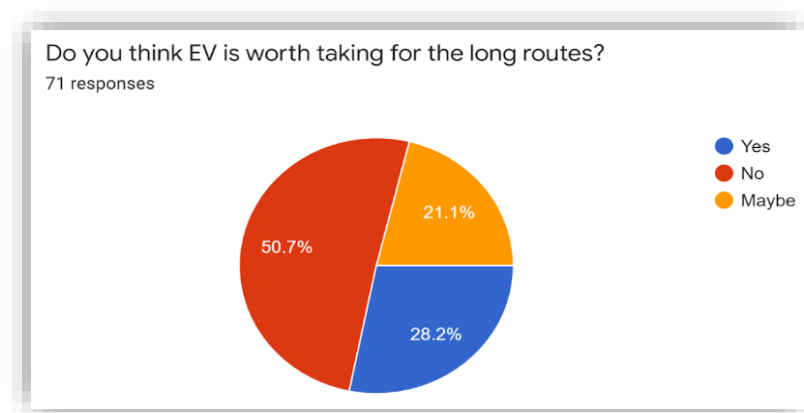
6. 33.8% consumer thinks that re-charging is the drawback /limitation while considering the EV



7. 53.5% responses think that currently it's too early to say that EV are reliable enough



8. Approx. more than half of the consumers i.e., 50.7% thinks that EV is not worth taking for longer routes



## Hypothesis Testing

### Test 1:

For the test we have conducted a two-sample chi-square test.

We have assumed the following:

H0: Demographics are not preferred for buying an electric vehicle

H1: Demographics are preferred for buying an electric vehicle

**Table 1: Observed Frequency (OF) Data:**

Row Labels	Conventional Vehicle	Electrical Vehicle	Hybrid Vehicle (Electrical & Petrol)	LPG/CNG Vehicle	Grand Total
Female	0	2	5	0	7
Male	5	21	35	4	65
<b>Grand Total</b>	<b>5</b>	<b>23</b>	<b>40</b>	<b>4</b>	<b>72</b>

**Table 2: Expected Frequency (EF) Data:**

Row Labels	Conventional Vehicle	Electrical Vehicle	Hybrid Vehicle (Electrical & Petrol)	LPG/CNG Vehicle	Grand Total
Female	0.486	2.236	3.889	0.389	7
Male	4.514	20.764	36.111	3.611	65
<b>Grand Total</b>	<b>5</b>	<b>23</b>	<b>40</b>	<b>4</b>	<b>72</b>



**Table 3:** <sup>3</sup> **Observed and Expected Frequency Data:**

Observed Frequency (OF)	Expected Frequency (EF)	OF-EF	(OF-EF) <sup>2</sup>	(OF-EF) <sup>2</sup> /EF
0	0.486	-0.486	0.236	0.49
2	2.236	-0.236	0.056	0.02
5	3.889	1.111	1.235	0.32
0	0.389	-0.389	0.151	0.39
5	4.51	0.486	0.236	0.05
21	20.76	0.236	0.056	0.00
35	36.11	-1.111	1.235	0.03
4	3.61	0.389	0.151	0.04
<b>Chi-Square Value</b>				<b>1.35</b>

**Table 4:** <sup>4</sup> **Calculation of Degree of Freedom (DF), Critical Value (CV)**

**and Probability (P-Value):**

Significance	<sup>4</sup> Degree of Freedom (DF)	Critical Value (CV)	Probability Value (P-V)
0.05	3	7.81	0.72

**Hypothesis Test 1 Conclusion:**

<sup>8</sup> Since the calculated chi-square value 1.35 is less than the critical chi-square value of 7.81, there is a strong evidence to accept the null hypothesis (H<sub>0</sub>) that demographics are not preferred for buying an electric vehicle.

Therefore, we reject H<sub>1</sub>, i.e; demographics are preferred for buying an electric vehicle. We conclude that there is no significant association between gender and EV preferences.

## **Test 2:**

For the test we have conducted a two-sample chi-square test.

We have assumed the following:

H0: Brands are not more preferred as an EV

H1: Brands are more preferred as an EV

**Table 1: Observed Frequency (OF) Data:**

<b>Row Labels</b>	<b>Hyundai</b>	<b>Maruti Suzuki</b>	<b>MG</b>	<b>TATA</b>	<b>Others</b>	<b>Grand Total</b>
Electric Bicycle	0	0	0	1	0	1
Electric Bike	1	4	1	2	1	9
Electric Car	7	10	3	26	6	52
Electric Scooty	1	1	0	4	2	8
Other	0	0	0	0	2	2
<b>Grand Total</b>	<b>9</b>	<b>15</b>	<b>4</b>	<b>33</b>	<b>11</b>	<b>72</b>

**Table 2: Expected Frequency (EF) Data:**

<b>Row Labels</b>	<b>Hyundai</b>	<b>Maruti Suzuki</b>	<b>MG</b>	<b>TATA</b>	<b>Others</b>	<b>Grand Total</b>
Electric Bicycle	0.13	0.21	0.06	0.46	0.15	1.00
Electric Bike	1.13	1.88	0.50	4.13	1.38	9.00
Electric Car	6.50	10.83	2.89	23.83	7.94	52.00
Electric Scooty	1.00	1.67	0.44	3.67	1.22	8.00
Other	0.25	0.42	0.11	0.92	0.31	2.00
<b>Grand Total</b>	<b>9</b>	<b>15</b>	<b>4</b>	<b>33</b>	<b>11</b>	<b>72</b>

**Table 3:** <sup>3</sup> **Observed and Expected Frequency Data:**

Observed Frequency (OF)	Expected Frequency (EF)	OF-EF	(OF-EF) <sup>2</sup>	(OF-EF) <sup>2</sup> /EF
0	0.13	-0.125	0.016	0.13
0	0.21	-0.208	0.043	0.21
0	0.06	-0.056	0.003	0.06
1	0.46	0.542	0.293	0.64
0	0.15	-0.153	0.023	0.15
1	1.13	-0.125	0.016	0.01
4	1.88	2.125	4.516	2.41
1	0.50	0.500	0.250	0.50
2	4.13	-2.125	4.516	1.09
1	1.38	-0.375	0.141	0.10
7	6.50	0.500	0.250	0.04
10	10.83	-0.833	0.694	0.06
3	2.89	0.111	0.012	0.00
26	23.83	2.167	4.694	0.20
6	7.94	-1.944	3.781	0.48
1	1.00	0.000	0.000	0.00
1	1.67	-0.667	0.444	0.27
0	0.44	-0.444	0.198	0.44
4	3.67	0.333	0.111	0.03
2	1.22	0.778	0.605	0.49
0	0.25	-0.250	0.063	0.25
0	0.42	-0.417	0.174	0.42
0	0.11	-0.111	0.012	0.11
0	0.92	-0.917	0.840	0.92
2	0.31	1.694	2.871	9.40
<b>Chi Square Value</b>				<b>18.41</b>

**Table 4: Calculation of Degree of Freedom (DF), Critical Value (CV) and Probability (P-Value):**

Significance	Degree of Freedom (DF)	Critical Value (CV)	Probability Value (P-V)
0.05	16	26.30	0.30

**Hypothesis Test 2 Conclusion:**

Since the calculated chi-square value 18.41 is less than the critical chi-square value of 26.20, there is a strong evidence to accept the null hypothesis (H0) that brands are not more preferred as an EV.

Therefore, we reject H1, i.e; brands are more preferred as an EV. We conclude that there is no significant association between brand and an EV.

**Test 3:**

For the test we have conducted a two-sample chi-square test.

We have assumed the following:

H0: Earnings does not play vital role for EV

H1: Earnings do play a vital role for EV

**Table 1: Observed Frequency (OF) Data:**

Row Labels	Buying EV			Grand Total
	Yes	No	Maybe	
INR 10,00,000 - INR 50,00,000	18	5	9	32
INR 3,00,000 - INR 5,00,000	9	0	2	11
INR 5,00,000 - INR 10,00,000	10	2	8	20
More than INR 50,00,000	6	1	2	9
<b>Grand Total</b>	<b>43</b>	<b>8</b>	<b>21</b>	<b>72</b>

**Table 2: Expected Frequency (EF) Data:**

Row Labels	Buying EV			Grand Total
	Yes	No	Maybe	
INR 10,00,000 - INR 50,00,000	19.11	3.56	9.33	32
INR 3,00,000 - INR 5,00,000	6.57	1.22	3.21	11
INR 5,00,000 - INR 10,00,000	11.94	2.22	5.83	20
More than INR 50,00,000	5.38	1.00	2.63	9
<b>Grand Total</b>	<b>43</b>	<b>8</b>	<b>21</b>	<b>72</b>

**Table 3: Observed and Expected Frequency Data:**

Observed Frequency (OF)	Expected Frequency (EF)	OF-EF	(OF-EF)^2	(OF-EF)^2/EF
18	19.11	-1.111	1.235	0.06
5	3.56	1.444	2.086	0.59
9	9.33	-0.333	0.111	0.01
9	6.57	2.431	5.908	0.90
0	1.22	-1.222	1.494	1.22

2	3.21	-1.208	1.460	0.46
10	11.94	-1.944	3.781	0.32
2	2.22	-0.222	0.049	0.02
8	5.83	2.167	4.694	0.80
6	5.38	0.625	0.391	0.07
1	1.00	0.000	0.000	0.00
2	2.63	-0.625	0.391	0.15
<b>Chi Square</b>				<b>4.60</b>

**Table 4: Calculation of Degree of Freedom (DF), Critical Value (CV) and Probability (P-Value):**

Significance	Degree of Freedom (DF)	Critical Value (CV)	Probability Value (P-V)
0.05	6	12.59	0.60

**Hypothesis Test 3 Conclusion:**

Since the calculated chi-square value 4.60 is less than the critical chi-square value of 12.59, there is a strong evidence to accept the null hypothesis (H<sub>0</sub>) that earnings does not play vital role for EV.

Therefore, we reject H<sub>1</sub>, i.e; earnings do play a vital role for EV. We conclude that there is no significant association between earnings and EV.

## Recommendations

1. Development of a policy as national policy and prepare roadmap: In order to produce a notable effect by EV development actions, it is necessary to introduce as many EVs as possible. For this, medium- and long-term policies on EVs should be carried in the coordination among the related agencies and organizations.
2. Other than GOI (central), there are many other stakeholders whose opinion must be sought, including those groups which may be affected negatively by the introduction of EVs. Therefore, EV development should be included in the national policy to effectively promote the implementation of related projects and actions. Furthermore, showing concrete EV policy in the short, medium, and long term can help clarify the direction of relevant agencies, and facilitate the sharing of the progress of the policy among these agencies.
3. Implementation system: There is no base to introduce and promote E Vehicles. Following are as preparatory steps:
  - (i) Establishment of Electrical Vehicle to get ready committee: Committee is base

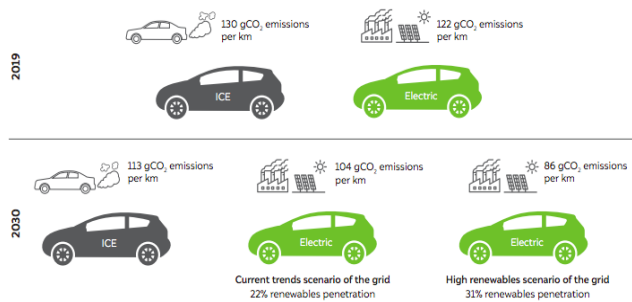
body which will formal preparatory tasks to promote Electrical Vehicle.

- (ii) Preparation of Electrical Vehicle master plan: This is basic directions for Electrical Vehicle development. Electrical Vehicle master plan will be formulated based on feedback study by region and issues.
- (iii) Basic regulations related Electrical Vehicle master plan will be formulated to build: <sup>1</sup> it is required to develop basic regulations on import of material, registration of Electrical Vehicle master plan to be formulated, as well as O & M Electrical Vehicle because private automobile enterprises have already introduced Electrical Vehicle master plan will be formulated Electrical Vehicle. In between, the minimum as and when <sup>1</sup> required regulations will be prepared for market needs.
- (iv) Development in human resources: The mechanism to develop human resources for Electrical will be developed in both government, public and private sector.



4. Conduct Pilot project: The implementation of the pilot and model Electrical Vehicle project is very effective and result ordinated to evaluate the feasibility and the impact of Electrical Vehicle introduction & conduct capacity building of Electrical Vehicle. The model pilot project can enable<sup>1</sup> for full-fledged Electrical Vehicle development and to stronger the implementation.

CO2 emissions per kilometer will be lower in an electric car compared to an ICE car in 2030



<https://www.ceew.in/publications/indias-electric-vehicle->

## Limitations

<sup>1</sup> To implementation of many pilot projects and EV related events, public expectation on Electrical Vehicle is high. However, there is no clear direction for full-fledged net movement. This is because of

1. High cost of Electrical Vehicle, the common limitation in all policies is that the incentives are only applicable for up to a certain number of vehicles only and after removing the discount and incentives the same EV which was looking lucrative to buy suddenly becomes unaffordable. This tells that buying EV's no more be cheaper after a certain saturation point.
2. High battery price: The Li-ion battery is very high and it is not hidden<sup>2</sup> in electric vehicles is built to last till 6-7 years or hardly 8 years and after the battery decay period of an electric vehicle battery its user remains with no other choice than to buy a newer battery which costs nearly 3/4 th of the whole vehicle cost.



3. Limited models, Electrical Vehicle has made many changes in their policies, software, hardware, and not even Tata motors has to upgrade their BMS and regen software after a lot of complaints from the customers regarding extremely low range. So, buying the Electrical Vehicle from the firstly from company's production is a bad deal or idea and it gives extremely bad experience also.
4. Lack of charging infrastructure: Poor infrastructure is among the most pressing issue among people thinking to opt for electric vehicles. Poor infra doesn't only include a lack of charging stations but also the lack of proper charging set up in their home. Charging a heavier electric car could be a major problem for any electric car owner if he/she lacks proper setup (Powerful MCB, wire, and earthing) near their place.
5. Temperature issue Temperature can affect the performance of an EV battery at a large extent which makes EV's inappropriate for too cold (Uttarakhand, Meghalaya) or too hot regions like (Rajasthan, Kerala). The battery can give its ideal performance when it's in use under the temperature range of 15-40 degrees

6. Trust: Lack of trust on Electrical Vehicle<sup>1</sup> in the market particular terms of life span of Electrical Vehicle and safety.

## Safety considerations for electric vehicles



## Conclusion

Despite being a developing nation India's continuous effort towards sustainable development mostly pinned on making the economy free from carbon emissions. For this India's biggest step is towards mobilizing electric vehicles. The Indian auto mobile industry is growing rapidly, with demand for passenger vehicles, commercial and two-wheeler vehicles. The Government of India has become the change agent by initiating plan to procure the EVs at the economical rates. <sup>21</sup> Department of heavy industries under the Ministry of Heavy Industries, GoI, had <sup>20</sup> introduced the National Electric Mobility Mission Plan 2020, which includes a scheme called "Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME)", that aims to widely increase the usage of EV on roads. This FAME scheme supports the ambition of making EV more affordable for the common people by reducing their overall price through subsidy mechanism.

There is a positive impact of EV on employment. As per the European Climate Foundation it has been estimated that by substituting oil demands by EV, global employment has the direct effect on it. It can be increased by 5 Lacs to 8.5 Lacs by 2030.

Consumer perception plays a vital role in building up or breaking down any brand or project. It is

changing rapidly, and brands are considering it significantly. As per the responses received for this project, the consumers are aware about the subsidies provided by the GoI and they are ready to switch from their fossil fuels cars to hybrid EV cars. Cost of the EV is an important factor for consumers when they buy an EV. Consumers are ready and willing to consider EV's for their future rides. Consumers also need the easy accessibility of charging at their homes/apartments (overnight charging).

Even the private sectors are also taking the benefits of the GoI initiative by carrying out the use of EV and strongly pushing their sales in the market.

Future of EV in India is bright, and they are focused on its prime environmental agenda to reduce its dependencies on fossil fuels. With newer models, battery technologies every day and fast charging time, we will see the new and better range of EV's.

## Questionnaire

Please find below the link for the questionnaire for the “Consumer perception of EV in India”:

<https://forms.gle/k21Qs8vyQsdK8SNS9>

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