The Growth of Electric Vehicle Registration in the Regional Offices of Uttarakhand

Krishna Kumar Verma[1], Jyoti Singh[2]
[1]Professor, Department of Commerce, Hemvati Nandan Bahuguna Garhwal University, (A Central University), Srinagar, Uttarakhand.
[2]Assistant Professor, Department of Commerce & Management, Ramanand Institute of Pharmacy &Management, Haridwar, Uttarakhand

Abstract

This study aimed to study the current status of electric vehicles in Dehradun and Uttarakhand. The secondary data related to different types of cars registered in RTO offices in different years based on the wheeler and fuel were collected from the RTO office for 2014, 2018, 2019, and 2023. The data were classified according to time, i.e., 2014, 2018, and 2019, to see the changing behavior of vehicles sold by different agencies in the district. The CAGR is the annual growth rate vehicle. The growth of vehicles in the market increased at an increasing growth rate (245 percent) during 2021 and (505 percent) in 2022. The simple growth rate of electric two-wheelers was estimated to be 779 percent growth during 2018 over the preceding year 2017 and 523 percent during 2017 over the preceding years. The study concluded that consumers' interest has shifted from non-electric vehicles to electric vehicles.

Keywords: Electric Vehicles, Growth, Two-wheeler, Three-wheeler, Four-wheeler.

Corresponding Author: Jyoti Singh, Assistant Professor, Department of Commerce & Management, Ramanand Institute of Pharmacy & Management, Haridwar, Uttarakhand. Email: jyotisngh01@gmail.com
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Introduction

An electric vehicle operates using an electric motor that receives power from a battery and can be charged using an external source. Batteries power electric vehicles and are increasingly popular due to their eco-friendly nature and lower operating costs**.**

The first electric car appeared in India in the late 19th century, but it wasn't until the 1960s that battery technology improved enough to make EVs practical for everyday use. Unfortunately, a lack of infrastructure and government support hindered their widespread adoption.

Over the past ten years, there has been a revitalized effort to promote electric vehicles in the nation. Several Indian companies, such as Mahindra & Mahindra and Tata Motors, have launched EV models, and global giants like Tesla, BYD, and NIO have also entered the market.

To encourage the people for adoption of EVs, the government has given various incentives and framed regulations. For instance, the FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles)

program offers financial incentives for buying electric and hybrid vehicles, and several states provide extra advantages like exemptions on road taxes and have established pro-EV regulations, including specific charging areas and lanes reserved for electric vehicles.

Charging infrastructure:

Although our country still lags in public charging infrastructure facilities. The government had plans to install at least one charging station per city by 2023. Additionally, many residential complexes, malls, and office buildings now offer EV charging facilities.

This paper studies Uttarakhand, a state located in the Himalayan region of northern India.

The state government has established a policy to promote EVs in the state. Under the "Electric Vehicle Policy," announced in 2018, various incentives are offered, such as subsidies on different domestic terms, tax exemptions, and preferential treatment for Electric vehicle owners. There are currently around 20 public charging stations installed in the state. Initially, this facility was available in Dehradun and Haridwar but was a Level-II charging station, which took more time to charge the battery.

Public transportation:

Uttarakhand is introducing EVs in the public transportation system. In 2019, the state's transport corporation introduced two electric buses in Dehradun and are planned to be added soon.

Private sector initiatives:

Several private companies in the state have adopted Electric vehicles. The Taj Hotel chain has deployed eco-friendly electric cars for guest transfers within Dehradun city.

Residential usage:

Although not widely adopted, some individuals in the state have started using EVs for personal transportation. These early adopters mainly comprise tech enthusiasts, environmentally conscious citizens, and economic benefits groups.

Challenges:

The restricted variety of electric vehicle models, insufficient awareness regarding EVs, and their higher price relative to traditional vehicles pose significant hurdles to the expansion and evolution of the electric vehicle market in the state.

Literature Review

*S. Jatinder (2014)***,** analyzed the influence of evolving policies on the progress and advancement of the Indian Automobile Sector. The impact of these policy changes on economic growth provides a competitive

edge. The segment of passenger vehicles significantly contributed to the expansion of exports and enhancement. The portion of the Indian Automobile Industry in total exports has seen a twofold increase over the years.

N. Chandrasekar & Palanivelu V.R, (2018), From the study growth rate of two-wheelers was seen as higher than other types of vehicles in India. The data was analysed with the help of simple percentage, mean, standard deviation, coefficient of variation, and compound annual growth rate. It was also found from the study that the export of automobiles in India increased considerably.

Arya N. (2019), studied automobile performance and growth in India were examined the domestic sales of vehicles with the support of government policies that have led to a climb up the Indian Automobile Industry.

Kaur. A (2020), examined the performance of Automobile Industry with the help of secondary data and the Compound Annual Growth rate was computed. The growth of production year over year, total export share, trade balance, compound annual growth rate and export market share in the world were estimated.

Manickkavasagam. N & Radhika. R. R (2019), the current scenario of growth and performance of the Indian Automobile Industry, and GST implementation showed a negative effect on the export of cars and tax was refunded by the Indian government to respective companies till February 2018.

Miglani. S (2019), the automobile industry being an important driver for economic growth in India. The Industry plays an important role in the global value chain with higher participation levels in the global market. Government policy, infrastructure facilities, and other enabling factors play a critical role in expanding Automobile sectors. The author explains the Automobile journey from 1950 and estimates the CAGR of production, Domestic Sales, and Export of passenger, commercial, Three-wheeler, and Two-wheeler vehicles from 1995-2000, 2001-2010, and 2011 -2018.

Tripathi, V. V. R., & Jaiswal, R. (2023), in their study on how loyalty programs affect impulsive purchasing, in addition to awareness and attitude, impulsive purchasing is significantly influenced by attractiveness, perceived value, rewards, and trust. For scholars, academics, and policymakers, this research provides insightful information that improves their comprehension of modern digital consumer behavior. Furthermore, it provides marketers the essential data required to create successful e-loyalty initiatives, providing a stiff competition in a market that is becoming more and more cutthroat.

Objectives

- To Study the current status of electric vehicles in Dehradun and Uttarakhand
- To analyze the growth of electric vehicles in Dehradun and Uttarakhand

Research Methodology

In this study, secondary data are used and collected from different sources. The secondary data related to different types of vehicles registered in RTO offices in different years based on the wheeler and fuel were collected from the RTO office from 2014 to 2023 for the study areas, i.e. Dehradun District from

Uttarakhand. The data were classified based on time, i.e., 2014, 2018, 2019, and 2023, to see the changing behavior of vehicles sold by different agencies in the district. The data was further classified considering the two-wheeler, three-wheeler, and light four-wheeler, i.e. car into consideration.

Growth is the quantitative improvement in any field (Automobile). The growth may be estimated as simple, annual growth and compound annual growth rate. It is necessary to mention here that the improvement or growth may also be shown in multiple times of improvement. In the present situation, all three types of progress and growth were estimated in Automobile Products, i.e., electric two-wheelers, three-wheelers, and four-wheelers.

The Compound Annual Growth rate of electric vehicles of two different survey areas, i.e., Dehradun & Uttarakhand, was calculated for all types of vehicles, i.e., two-wheeler, three-wheeler, and four-wheeler. The CAGR is the annual growth rate of vehicles. For computing the Growth rate the following formulas were used:

i) Simple Growth Growth = $\frac{\text{C.Y.-P.Y.}}{\text{P.Y.}}$ x 100 = Percentage

ii) 5-years Change = $\frac{\text{C.Y.-B.Y.}}{\text{B.Y.}}$ x 100 = Times

iii) 10-year Change = $\frac{\text{C.Y.-B.Y.}}{\text{B.Y.}}$ x 100 = Times

iv) CAGR = $\left(\frac{\textit{Ending Year}}{\textit{Beginning Years}}\right)^{1/n}$ -1, then answer multiplied by 100 = Percentage

Whereas, C.Y= Current Year, P.Y=Previous Year or Preceding Year, B.Y=Base Year

Data Analysis and Interpretation

Table-1 Changes during last 10 years of Electric Vehicles in Dehradun

Types	2014	2018	5-year change in 2018 over 2014 (%)	2019	2023	5-year change in 2023 over 2019(%)	10-year change in 2023 over 2014(%)
Two-wheeler	5	87	1640	150	2792	1761.33	55740
Three-wheeler	-	1263	100	684	1571	129.68	100
Four-wheeler	-	-	0	1	294	99.66	100

Source: Ministry of Road Transport &Highway, Government of India, Author Compilation and Calculation

Table 1 shows the data for two-wheelers, three-wheelers, and four-wheelers for 2014, 2018, 2019, and 2023. It can be observed from the Table 1 that there were only five vehicles of two-wheelers registered in the RTO office for getting licenses, while none of the cars had three-wheelers and four-wheelers registered in the RTO office. The same situation was seen in 2014 with four-wheeler electric vehicles. A good number of

three-wheeler electric vehicles were registered during the year 2018 (1263). It was interesting to mention here that during 2023, a good number of two-wheeler electric (2792) and four-wheeler electric vehicles (294) were registered. However, the number of three-wheeler registrations increased during 2023, i.e., 1571, as compared to 684 during 2019, accounting for a 129.68 increment in 2023 over 2019 of three-wheelers. It was further stated that the change during 2023 over 2019 in the case of two-wheelers accounted for a 1761 percent increase in electric two-wheelers and interest of vehicle owners shifting to electric two-wheelers as an advancing period. It was further stated that the four-wheeler that was registered in the RTO office took 1st place during the period between 2019 to 2023 i.e. 294 electric cars accounting for 99.66 percent change in the overtime period. Surprisingly, the interest of two-wheeler users increased rapidly during the 10 years because change was estimated in 55740 percent of electric two-wheelers were registered during 2023. It was found from the Table 1 that the use of electric vehicles was increasing positively with time advancement. The survey further observed that electric vehicles had many challenges in the field because very few charging stations/charging points were available in the study area and need to increase.

Table 2 Changes during last 10 years of Electric Vehicles in Uttarakhand

Types	2014	2018	5-year change in 2018 over 2014 (%)	2019	2023	5-year change in 2023 over 2019(%)	10-year change in 2023 over 2014(%)
Two-wheeler	9	255	2733	492	5688	1056.09	63100
Three-wheeler	0	4815	100	5325	10618	99.39	100
Four-wheeler	0	0	0	1	480	47900	100

Source: Ministry of Road Transport &Highway, Government of India, Author Compilation and Calculation

The electric vehicles in the state came out in the market nearly one and half decades earlier in the form of two-wheelers (2014), but three-wheelers and four-wheelers came out on the road nearly half a decade earlier in the state, i.e., 2018 and 2019. It shows that the availability of electric vehicles in all forms, i.e., two-wheelers, three-wheelers, and small four-wheelers (cars), has taken place recently in the state, i.e., 2019. It can be observed from the data that the interest of people is increasing rapidly. It can be further observed from the Table 2 that during 2023, approximately 5688 two-wheelers, 10618 three-wheelers, and 480 four-wheelers (cars) were registered in 2023. It was interesting to mention here that during 10 years from 2014-2023, approximately 63100 percent of two-wheelers were registered during 2023 over 2014. However, it was necessary to report here that the number of three-wheelers and four-wheeler electric vehicles sold and registered during 2023 indicated a higher interest of vehicle owners in buying commercial vehicles and using three-wheelers as commercial-based vehicles compared to other types of vehicles. This indicated that electric vehicles had become substitutes for conventional fuel vehicles, i.e., Diesel, Petrol, CNG, etc., which may be cost-effective and more beneficial to commercial vehicle users.

Table 3 Present Position of Electric Vehicles in Dehradun over Uttarakhand state

Year	Two-Wheeler		Three-Wheeler		Four-Wheeler	
	Dehradun	Uttarakhand	Dehradun	Uttarakhand	Dehradun	Uttarakhand
2014	5(55.55)	9	0(00)	0	0(00)	0
2015	11(84.62)	13	0(00)	1	0(00)	0
2016	21(63.64)	33	73(6.49)	1125	0(00)	0
2017	17(58.62)	29	568(13.54)	4195	0(00)	0
2018	87(34.12)	255	1263(26.23)	4815	0(00)	0
2019	150(30.49)	492	684(12.85)	5325	1(100)	1
2020	39(21.91)	178	107(4.85)	2205	13(100)	13
2021	222(18.33)	1211	272(6.92)	3931	55(47.01)	117
2022	2028(35.60)	5696	1054(11.15)	9456	235(65.28)	360
2023	2792(49.08)	5688	1571(14.79)	10618	294(61.25)	480

Source: Ministry of Road Transport &Highway, Government of India, Author Compilation and Calculation

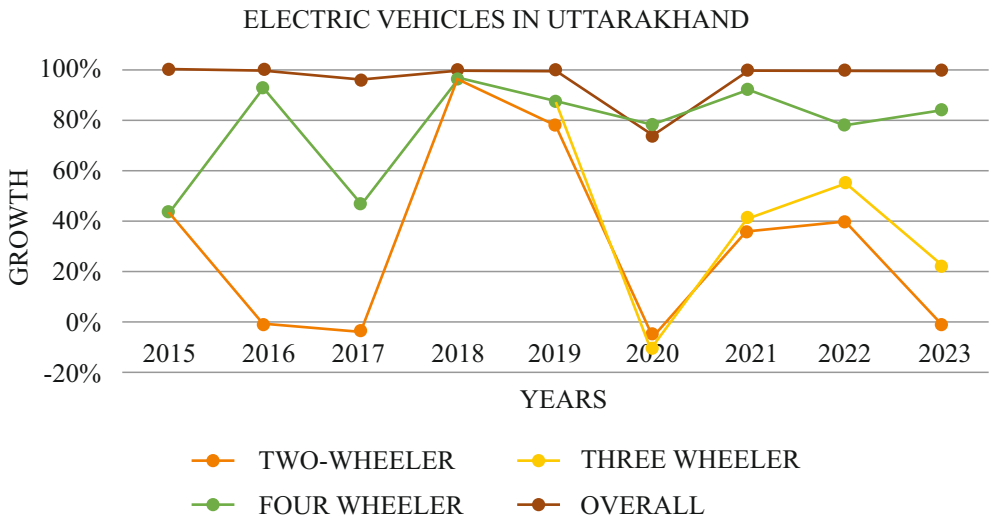
The details of electric vehicles i.e. two-wheelers, three-wheelers, and four-wheelers (car) were shown year-wise from 2014 to 2023 in Table No-3. It can be observed from the Table 3 that more than fifty percent of two-wheeler electric vehicles were only in Dehradun, indicating that the people residing in Dehradun are interested in purchasing and using two-wheeler electric vehicles as opposed to their counterparts. However, none of the three-wheelers (electric) was seen in Dehradun during 2014 and 2015. The worst interest condition of the people who belong to Dehradun was that none had four-wheeler electric vehicles till 2018, while only a single electric car was in the district of Dehradun and the state of Uttarakhand in 2019. It was further revealed from the Table 3 that the number of all types of electric vehicles increased during 2023 over a decade. 49 percent of electric two-wheelers were sold and registered only in Dehradun as in comparison to other parts of the state, but only 15 percent of commercial electric three-wheelers were seen in the Table 3 during 2023 as compared to other parts of the state. It was interesting to mention here that the total number of four-wheelers, i.e., car (480), was registered in the state in 2023. According to the state figure, more than 61 percent of the state's total electric four-wheeler vehicles were registered in Dehradun in 2023. This may be due to the availability of good infrastructure facilities for electric vehicles in Dehradun compared to the other parts of the state. Secondly, Dehradun is the state's capital, where a higher income group population was inhabitant in the district compared to other districts. Thirdly, many service classes from government offices, education, research centers, companies, and factories live in Dehradun and have a good knowledge and interest in electric vehicles.

Table-4 Growth and Change in Electric Vehicles in Uttarakhand

Year	Two-Wheeler		Three-Wheeler		Four-Wheeler		Overall	
	Number	Change	Number	Change	Number	Change	Number	Change
2014	9	-	-		-	-	9	-
2015	13	44.44	1	-	-	-	14	55.56
2016	33	153.85	1125	112400	-	-	1158	8171.42
2017	29	-12.12	4192	272.89	-	-	4224	264.77
2018	255	779.31	4815	14.78	-	-	5070	20.03
2019	492	92.94	5325	10.59	1	-	5818	14.75
2020	178	-63.82	2205	-58.59	13	1200	2396	-58.82
2021	1211	580.34	3981	78.28	117	800	5259	119.49
2022	5696	370.36	9456	140.55	360	207.69	15512	194.96
2023	5688	-0.14	10618	12.29	480	33.33	16786	8.21

Source: Authors' Calculation, Ministry of Road Transport &Highway, Government of India

Graph-4.1 Growth of E- Vehicles in Uttarakhand State (Change over the previous year)



The electric vehicles seen in the state in 2014 were electric two-wheelers (9), while three-wheelers were launched in 2015 with a negligible number (1) while electric four-wheelers were launched in 2019. The simple growth rate was estimated, and 779 percent of electric two-wheelers experienced growth in 2018 over 2017. The growth rate of electric three-wheelers was higher in 2017 than in 2016. It can be observed from the table that a negative growth rate was estimated both in case of Dehradun as well as Uttarakhand in the cases of electric two-wheelers (64 percent) and electric three-wheelers (59 percent) in the year 2020 over the preceding year, 2019. The sale and purchase number of vehicles during 2020 was lower than in previous years because of the effects of the COVID-19 pandemic and the lockdown situation. It was interesting to mention here that the number of electric three-wheelers in e-rikshaws and e-autos was increasing faster on the road because these vehicles were used for commercial purposes as a mode of transport in the city areas. Electric cars were introduced in 2020 in small numbers, and growth was 800 percent in 2021, followed by 207 percent in 2022. It can be noticed from the above Table that the growth rate of electric four-wheelers was

reduced and came down 33 percent in 2023 over the preceding year (2022). This shows the customer's confidence level towards vehicle quality and is environmentally beneficial in the state where conventional fuel vehicles share carbon dioxide in the environment and are harmful to living things, i.e., humans, animals, birds, and sea life. Therefore, the government prioritizes producing more electric vehicles and is planning to reduce the use of conventional fuel-based vehicles, i.e., petrol and diesel. Secondly, the rate of petrol, diesel, LPG, and CNG are increasing daily.

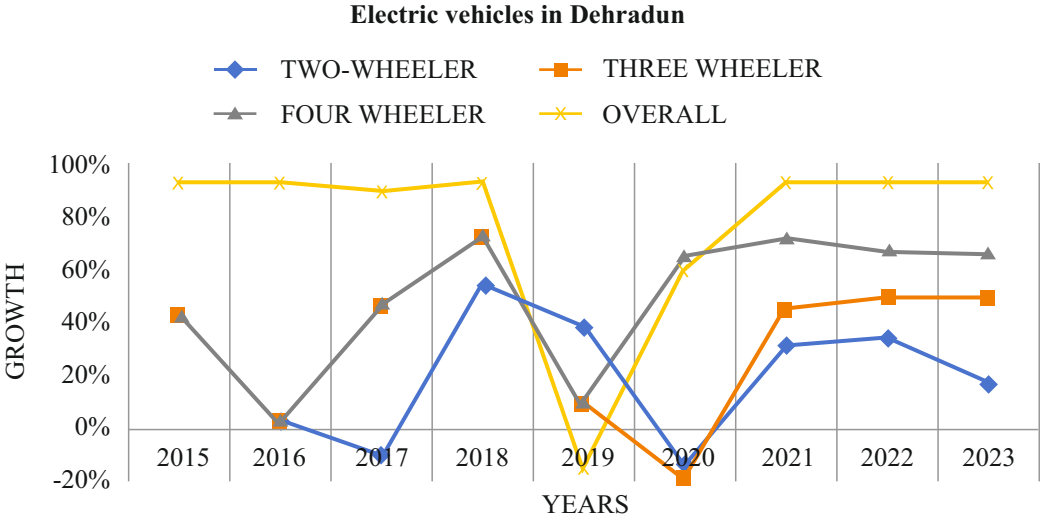
The overall situation of E-Vehicles in the State during the study years, i.e.2014 to 2023, is revealed in Table 4. The growth rate of E-Vehicles in the state varies between 8 percent growth rate in the year 2023 to the growth rate of 8171 percent in the year 2016 over their respective preceding year. It can be observed from the above Table 4 that the second place of growth of electric vehicles was (264 percent) in 2017 and, subsequently, 195 percent in the year 2022 over the preceding years. However, it can again be observed from the above table that negative growth was also seen in 2020 by 58 percent over the prior years of 2019. This situation occurred due to covid-19 effect. In a nutshell, it can be said that launching electric vehicles in different forms is beneficial to various dimensions and environmentally suitable to all.

Table 5 Growth of Electric Vehicles in Dehradun and changes over the previous year

Year	Two-Wheeler		Three-Wheeler		Four-Wheeler		Overall	
	Number	Change during C.Y over P.Y	Number	Change during C.Y over P.Y	Number	Change during C.Y over P.Y	Number	Change during C.Y over P.Y
2014	5	-	-	-	-	-	5	-
2015	11	120.00	-	-	-	-	11	120
2016	21	90.91	73	-	-	-	94	754.55
2017	17	-19.05	568	678.08	-	-	586	523.40
2018	87	411.76	1263	122.36	-	-	1350	130.38
2019	150	72.42	684	-45.84	1	-	835	-38.15
2020	39	-74.00	107	-84.36	13	1200.00	159	-80.96
2021	222	469.23	272	154.21	55	323.08	549	245.28
2022	2029	813.96	1054	287.50	235	327.27	3317	505.19
2023	2792	37.60	1571	49.05	294	25.17	4657	40.39

Source: Authors' Calculation, Ministry of Road Transport &Highway, Government of India

Graph -5.1 Growth of Electric Vehicles in Dehradun change over previous year



The simple growth rate of electric vehicles in Dehradun was calculated for two-wheelers, three-wheelers, and four-wheelers (cars) for 10 years from 2014 to 2023. The secondary data related to electric two-wheelers, three-wheelers, and four-wheelers (small cars) were collected from the respective RTO office of the districts and another secondary source, i.e., google and other government reports. The simple growth rate of 10 years was estimated and depicted in Table 5. In the case of two-wheelers, it can be observed from the analysis that a higher simple growth of 814 percent of electric vehicles of two-wheelers could be seen in the year 2022 over the preceding year 2021. However, the negative simple growth could be seen as 74 percent in the year 2020. The negative simple growth rate was 19 percent in 2017 over 2016. The negative growth during 2020 could be seen due to covid-19 pandemic. It is interesting to state that negative simple growth could be observed in the year 2017 over the year 2016, which may be the cause of bad performance and burning cases of electric two-wheelers before 2017. This was the residual effect of selling electric two-wheeler vehicles in 2017. The electric three-wheelers called the name of e-rikshaw and e-auto, was launched for the first time in the year 2016 in the Dehradun survey area, and their simple growth was estimated at 678 percent during 2017 over the preceding year, 2016. This was a higher growth of electric three-wheeler vehicles during 10 years of study periods. The negative growth rate in the years 2019 and 2020 was estimated to have a higher negative growth rate of 84 percent in 2020 over 2019. This may be the effect of covid-19 pandemic. The negative production and negative market are both responsible for the negative growth of these vehicles. After that, growth increased at an increasing growth rate (245 percent) during the year 2021 and (505 percent) in 2022, but the growth of vehicles in the market increased at a decreasing rate (40 percent) during 2023 over the preceding year 2022. The growth rate of electric four-wheelers was estimated, which was launched in 2019, with one electric four-wheeler registered in Dehradun RTO. After this, the number of electric four-wheelers increased at an increasing growth rate (327 percent) over the preceding years, 2022. It was also observed from the table that total electric four-wheelers, i.e., cars, increased during 2023, but the simple growth rate decreased (25 percent). This may be due to the electric car not being acceptable to customers because of limited charging facilities, low-power battery, and lightweight. In the overall situation, the simple growth rate was higher (754 percent) during 2016, followed by 523 percent during 2017 over the preceding years. Surprisingly, that negative growth (81 percent) was seen in the year 2020 because of the effect of covid-19 pandemic. After 2020, the number of vehicles increased in 2021 by 245 percent and in 2022 by 505 percent over the preceding years. The table further

revealed that the growth rate in 2023 over 2022 was a 40 percent increase with a decreasing rate.

Findings:

- It has been observed that the use of electric vehicles has increased positively with time advancement. It was further observed from the survey that there were many challenges for electric cars in the field because very few charging stations/charging points were available in the study area and need to increase.
- It was found from the study that in Dehradun, the number of three-wheelers and four-wheeler electric vehicles sold and registered during 2023 indicated higher interest of vehicle owners to buy commercial vehicles and use three-wheelers as commercial based as compared to other types of cars. This showed that electric vehicles had become substitutes for conventional fuel vehicles, i.e., Diesel, Petrol, CNG, etc., which may be cost-effective and more beneficial to commercial vehicle users.

- From the state figure, more than 61 percent of the total electric four-wheeler vehicles of the state were registered in Dehradun during 2023. This may be due to the availability of good infrastructure facilities for electric vehicles in Dehradun compared to the other parts of the state. Secondly, Dehradun is the state's capital, where a higher income group population was inhabitant in the district compared to other districts. Thirdly, many service classes from government offices, education, research centers, companies, and factories live in Dehradun and have a good knowledge and interest in electric vehicles.

- The overall situation of electric vehicles in the state during the study years, i.e.2014, to 2023, is given in Table No-4. The growth rate of electric vehicles in the state varies between an 8 percent growth rate in the year 2023 and a growth rate of 8171 percent in 2016 over their respective preceding year. It is observed from the table that the second place of growth of electric vehicles was (264 percent) in 2017 and, subsequently, 195 percent in the year 2022 over the preceding years. However, it is further observed from the table that the negative growth was also seen in 2020 by 58 percent over the preceding years of 2019. This situation was due to COVID-19 effect.

- Overall, the simple growth rate of Dehradun City was higher (754 percent) during 2016, followed by 523 percent in 2017 over the preceding years. Surprisingly, that negative growth (81 percent) was seen in the year 2020 because of the effect of covid-19 pandemic. After 2020, the number of vehicles increased in 2021 by 245 percent and in 2022 by 505 percent over the preceding years. The table further revealed that the growth rate in 2023 over 2022 was 40 percent increased but at a decreasing rate.

Conclusion

The study concluded that consumers' interest has shifted from non-electric vehicles to electric vehicles. Its main reasons are consumers' awareness regarding environmental concerns, the low cost of electric vehicles compared to fuel-based vehicles, and the easy portability of electric vehicles (weighted for senior citizens and ladies). As awareness of consumers regarding the dangerous effect of climate change increases the interest of consumers will shift to buy electric vehicles. In 2020, the number of sales and registered EVs rose by 30%, approx. in comparison to the 2019 in the country. In sum, it may be concluded that launching electric vehicles in different forms is beneficial and suitable for the environment, which is beneficial for all.

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