Analyzing the Emerging trends of Electric and Conventional Vehicle Usage in Dehradun

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

Abstract

The study focus on the current status of electric and conventional vehicles was assessed in Dehradun. A vehicle is defined as a machine, such as a car, bus, truck, bike, scooter, or auto rickshaw, whether electric or non-electric, that has an engine and is used to carry passengers from one location to another. The study categorizes vehicles into two types: electric and non-electric. Both electric and Non-electric vehicles are divided into three further categories groups i.e. two-wheelers, three-wheelers, and four-wheelers. This study's foundation is secondary data from the preceding ten years, from 2015 to 2024, collected from reports of the RTO office of Dehradun. After gathering the data, these were analyzed by statistical tools, such as simple growth rate, five-year change, and ten-year change of electric and conventional vehicles. The result of the analysis shows that the growth of electric vehicles increased from 2015 to 2024, while a decline was observed in non-electric three-wheelers and small four-wheelers (2024 compared to 2015). It has been determined from consumer purchasing that in Dehradun, interest and behavior have shifted from non-electric to electric vehicles.

Keywords: Electric Vehicles(EV),Non-Electric Vehicles(NEV),Simple Growth, Two-Wheeler(TW),Three-Wheeler(THW),and Four-Wheeler(FW)

Corresponding Author: Jyoti Singh, Assistant Professor, Department of Commerce &Management, Ramanand Institute of Pharmacy & Management, Haridwar, Uttarakhand, E-mail: jyotisng01@gmail.com
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Introduction:

The automobile industry is the economic sector that involves designing, developing, manufacturing, marketing, and selling motor vehicles such as cars, trucks, buses, motorcycles, and other vehicles. For the study, vehicles are separated into two groups according to fuel: Electric Vehicles (EV) and Non-Electric Vehicles (NEV).

Electric vehicles are powered by batteries using electricity, which is becoming increasingly popular due to their eco-friendly nature. Non-Electric Vehicles operate on fuels such as petrol, diesel, and hybrid options (CNG and gasoline), commonly called conventional vehicles.

Vehicles used in the study are further divided into: two-wheelers, such as bikes, scooters, and e-scooters; three-wheelers, including autos, e-autos, and e-rickshaws; and four-wheelers, which encompass small vehicles like cars, both electric and non-electric. The secondary data collected from the RTO office, government reports, and other sources were analysed to assess the status of vehicles in Dehradun.
Uttarakhand, a state in northern India's Himalayan region, has begun taking initial steps toward adopting

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electric vehicles. However, the EV market in Uttarakhand still requires several stages in order to frame a comprehensive policy framework to promote EVs in Uttarakhand. Currently there are roughly 20 public stations set up for automobile charging.

LITERATURE REVIEW

- *S. Jatinder (2014).* investigated how the Indian automobile industry grew and developed as a result of policy changes. A competitive advantage results from these policy changes' effects on development. Export growth and improvement were positively impacted by passenger cars. India's vehicle industry's overall exports have doubled.

- *N. Chandrasekar & Palanivelu V.R. (2018).* in India, two-wheelers grew more quickly than other kinds of vehicles. Simple percentages, means, standard deviations, coefficients of variation, and the annual compound growth rates were used for data analysis. On analysis it can be concluded that automobile exports of India have significantly increased in recent years.

- *Arya, N. (2019)* evaluated the development and the Indian car sector performance, focusing on domestic vehicle sales supported by policies of the government that have played a part in the rise of the Automobile Industry of India.

- *Kaur, A. (2020)* analyzed the Automobile Industry's performance using secondary data, calculating the Compound Growth Rate (annually). Global share in export market, yearly compound growth rate, total export share, production growth, and trade balance were all expected to be increasing.

- *Manickkavasagam, N. & Radhika, R. R. (2019)* talked about the present state of the Indian automobile industry's performance and growth, pointing out that the GIST's implementation hampered auto exports while the Indian government reimbursed connected companies for taxes till February 2018.

Objectives

- To determine the increase in electric and conventional vehicles in Dehradun, Uttarakhand.

- To determine the status of electric and conventional vehicles in Dehradun, Uttarakhand.

Research Technique

Research methodology is a process in which we give the details of the experiment, design, analytical methods, statistical tools, sampling methods, and tools used in the study. This framework aids in guiding the work conducted in the study, making it comprehensible to the researcher, reader, and other personnel involved in teaching, research, and extension work. The secondary data for electric two-wheelers, three-wheelers, and four-wheelers (small cars) were gathered from the respective RTO offices of the districts and other reports of the government. The list of vehicles was categorized into two groups: electric and non-electric vehicles. Data collection was transferred onto paper sheets, where details of the vehicles were recorded on a master sheet and subsequently entered into MS Excel for further analysis. This study estimated simple growth, comparing the current year to the previous year, five-year changes (2019 over 2015, 2024 over 2020), and ten-year changes (2024 over 2015). The growth rate was calculated with the following methods:

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- Simple Growth = $\frac{(C.Y - P.Y)}{(P.Y)} x\ 100$
- 5-Year Changes = $\frac{(C.Y - B.Y)}{(B.Y)} x\ 100$
- 10-Year Changes = $\frac{(C.Y - P.Y)}{(P.Y)} x\ 100$

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

Data Analysis and Interpretation

Table 1: The Status of E-Vehicles of Dehradun (in percentage) in Uttarakhand.

Year	Two-Wheeler		Three-Wheeler		Four-Wheeler	
	Dehradun	Uttarakhand	Dehradun	Uttarakhand	Dehradun	Uttarakhand
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
2024	3013(36.64)	8222	1641(14.95)	10974	534(54.94)	972

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

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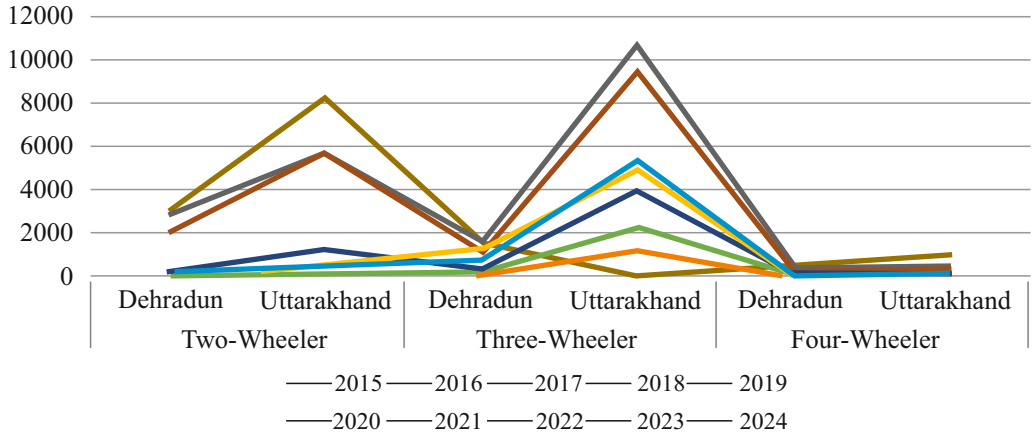
Graph -1: Status of E-Vehicles in Dehradun



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

Table 1 reveals the number of e-vehicles in Dehradun, which was computed as a percentage. The data was accumulated with the help of secondary sources, including the R.T.O. office of the district, Google, and other government reports. The table shows that in 2015, 85% registrations were for electric two-wheelers in Dehradun, while in 2016, this figure dropped to 64%. It was noted that in 2021, the lowest percentage of e-vehicles was registered in compared to the year prior due to COVID-19. As per the report, the number of electric two-wheeler registrations in the Dehradun survey region rose by 35% in 2023 as compared to 2022. Nonetheless, it increased by 36% in 2024, but at a slower pace than in 2023 (49%).

Furthermore, this data indicates that in 2015, there was just one electric three-wheeler registered in Uttarakhand and none in Dehradun. The data showed that the maximum number of e-three-wheelers was registered in 2018 (26 percent) compared to 2017 (14 percent). In 2020 (5 percent) and 2021 (7 percent), fewer electric three-wheelers were registered, likely the reason was COVID-19 pandemic. Conversely, analysis also revealed that the registration of electric three-wheelers increased at an accelerating rate in 2022 (11 percent), 2023 (15 percent), and remained steady in 2024 (15 percent).

The study indicates that commercial electric three-wheeler owners are keen on transitioning from non-electric vehicles to electric ones. No small four-wheelers were recorded from 2015 to 2018. Additionally, the table reveals that only a single electric four-wheeler was registered in Uttarakhand, specifically in Dehradun city. It is noted that electric four-wheeler registrations have risen over the previous five years, from 2020 to 2024. This increase could be ascribed to the well-developed infrastructure and facilities that support electric four-wheelers. In 2024, 534 small electric four-wheelers were purchased and registered in Dehradun, suggesting a promising market for electric four-wheelers in this survey area.

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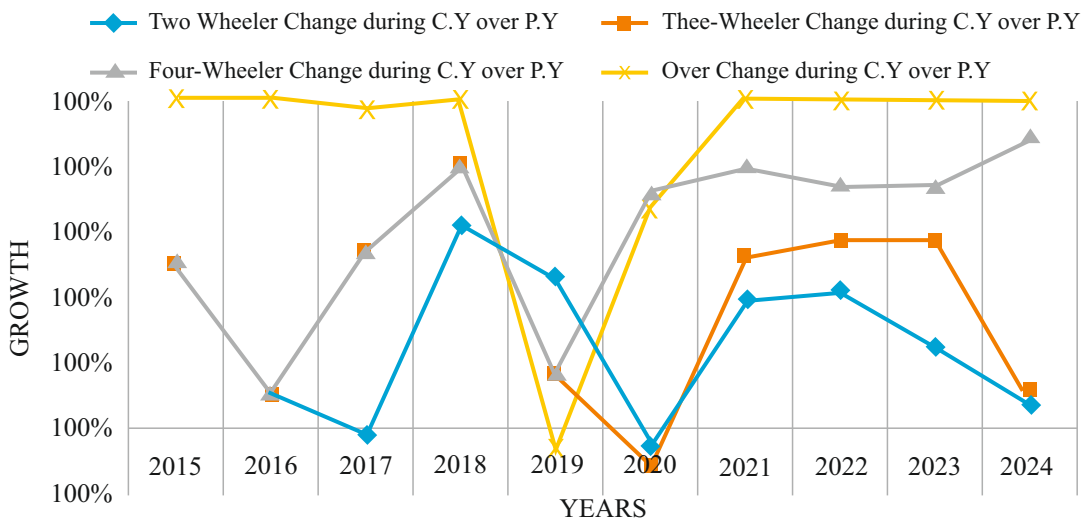
Table 2: Moving Growth of E-Vehicles in Dehradun

Year	Two-Wheeler	Three-Wheeler	Four-Wheeler	Overall
	Change during C.Y over P.Y	Change during C.Y over P.Y	Change during C.Y over P.Y	Change during C.Y over P.Y
2015	120.00	-	-	120
2016	90.91	-	-	754.55
2017	-19.05	678.08	-	523.40
2018	352.94	122.36	-	130.38
2019	72.42	-45.84	-	-38.15
2020	-74.00	-84.36	1200.00	-80.96
2021	464.10	154.21	323.08	245.28
2022	813.51	287.50	327.27	505.19
2023	37.60	49.05	25.17	40.39
2024	7.92	4.46	81.63	11.40

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

Graph -2 Moving Growth of E-Vehicles in Dehradun



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

In Dehradun, the simple growth rate for EV's was computed for two-wheelers, three-wheelers, and four-wheelers over a decade, from 2015 to 2024. The simple growth rate as revealed by Table No. 2. The analysis revealed a remarkable simple growth of 814 percent in e-two-wheelers in 2022 in contrast to the year prior, 2021. However, a negative simple growth of 74 percent was recorded in 2020. Additionally, a negative simple growth rate of 19 percent was observed in 2017 compared to 2016. The decline in 2020 was attributed to the COVID-19 pandemic. Notably, the negative simple growth in 2017 compared to 2016. Electric three-wheelers, known as e-rickshaws and e-autos, were introduced in the 2016 Dehradun survey area, and their simple growth was estimated at 678 percent in 2017 in contrast to the previous year, 2016. This represented

the highest increase of electric three-wheelers over the course of the ten-year study. The negative growth rates in 2019 and 2020 were significant, with a higher negative growth rate of 84 percent in 2020 compared to 2019, likely influenced by the COVID-19 pandemic. Both negative production and a declining market contributed to the negative growth of these vehicles. Subsequently, growth increased at a decreasing rate of 55% in 2022 and 40% in 2023, while the market growth in the cars rose at a decreasing rate of 11% in 2024 in contrast to the earlier year, 2023.

The rate of growth for e-four-wheelers was estimated, and it was launched in 2019, with one registered electric four-wheeler in the R.T.O., Dehradun. The table also reports that electric four-wheelers, i.e., cars, increased in 2024, with a straightforward attribute of 82 percent. This is attributable to the growing acceptance of e-vehicles among customers, facilitated by the availability of charging stations, powerful batteries, and lightweight designs. Overall, the simple growth rate of all e-vehicles was significantly higher at 754 percent in 2016, followed by 523 percent in 2017 compared to previous years. Surprisingly, a negative rate of growth of 81 percent was noted in 2020 because of COVID-19 pandemic.

Table 3: Growth of E-Vehicles, Dehradun

Types	2015	2019	5-year change in 2019 over 2015	2020	2024	5-year change in 2024 over 2020	10-year change in 2024 over 2015
Two-wheeler	11	150	12.63	39	3013	76.26	272.91
Three-wheeler	0	684	100	107	1641	14.34	100
Four-wheeler	0	1	100	13	534	40.08	100

Source: Ministry of Road Transport & Highways, Government of India,

Table 3 presents the data on e-vehicles in Dehradun over four years, namely 2015, 2019, 2020, and 2024. The table displays three kinds of vehicles: 2-wheelers, 3-wheelers, and 4-wheelers. Positive changes were observed in 2019 compared to 2015 and in 2024 compared to 2020 across all vehicle types mentioned. It was estimated that the overall number of registrations in 2024, compared to 2015, increased for all types of vehicles, indicating a shift in vehicle owners' preferences towards electric cars instead of fuel. Data analysis reveals that electric autos, electric rickshaws, and commercial e-3wheeler vehicles were gaining attraction in the auto market, with calculated and noted modifications in 2024 over five years (2020) being 76 percent, 14 percent, and 40 percent for two-wheelers, three-wheelers, and four-wheelers, respectively. Significant formulations were seen in the local and commercial vehicles market.

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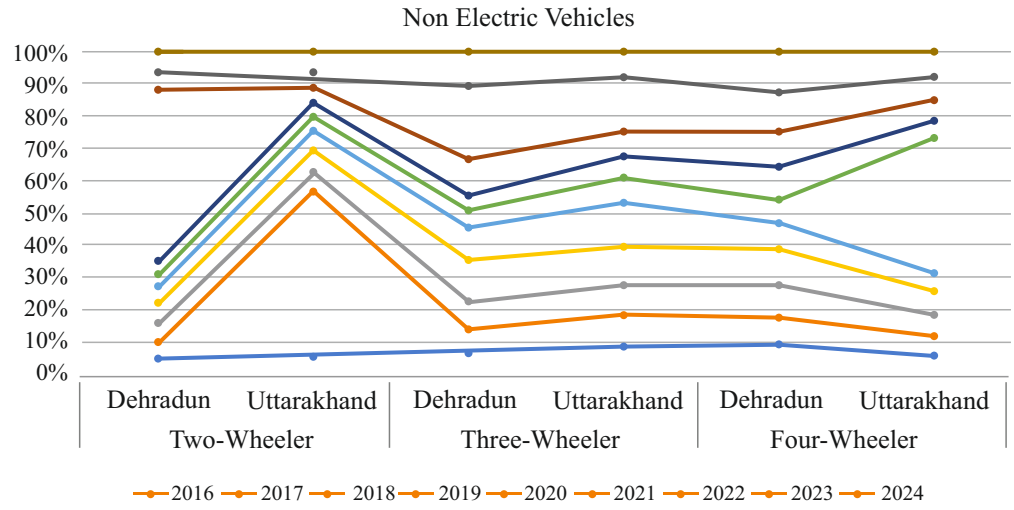
Table 4: Status of Conventional Vehicles, Uttarakhand

Year	Two-Wheeler		Three-Wheeler		Four-Wheeler	
	Dehradun	Uttarakhand	Dehradun	Uttarakhand	Dehradun	Uttarakhand
2015	41638(25.59)	162708	199(14.97)	1329	15476(39.04)	39644
2016	42105(24.85)	1629403	249(16.29)	1528	14861(39.17)	37942
2017	51115(25.99)	196662	281(19.29)	1457	17306(38.11)	45413
2018	54854(26.19)	209444	410(22.01)	1863	18161(37.79)	48049
2019	44739(24.46)	182871	337(15.35)	2195	14643(38.04)	38493
2020	31329(23.12)	135524	171(14.59)	1172	13425(4.75)	282336
2021	35934(26.32)	136503	161(15.41)	1045	16121(39.77)	40531
2022	457784(29.61)	154580	357(29.07)	1228	18900(42.95)	44007
2023	49319(29.27)	168476	744(28.14)	2644	20778(43.51)	47757
2024	54374(29.07)	187024	350(28.09)	1246	22123(42.92)	51542

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

Table No.4 depicts the positions of conventional vehicles of Dehradun and of the entire Uttarakhand during the last decade from 2015 to 2024. According to the table, 2022 saw the greatest number of two-wheelers registrations (29.61 percent), followed closely by 2023 (29.27 percent). For three-wheelers, a percentage of registration was higher in 2022 (29.07 percent), followed by 2023 (28.14 percent), and a similar trend was followed by four-wheelers in those respective years. Compared to 2023, it was seen that the percentage of registered automobiles for every kind of vehicle was lower in 2024. According to the report, Dehradun car owners' interest in and purchasing patterns have changed from non-electric to electric vehicles.

Graph -3: Status of Conventional Vehicles in Uttarakhand



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

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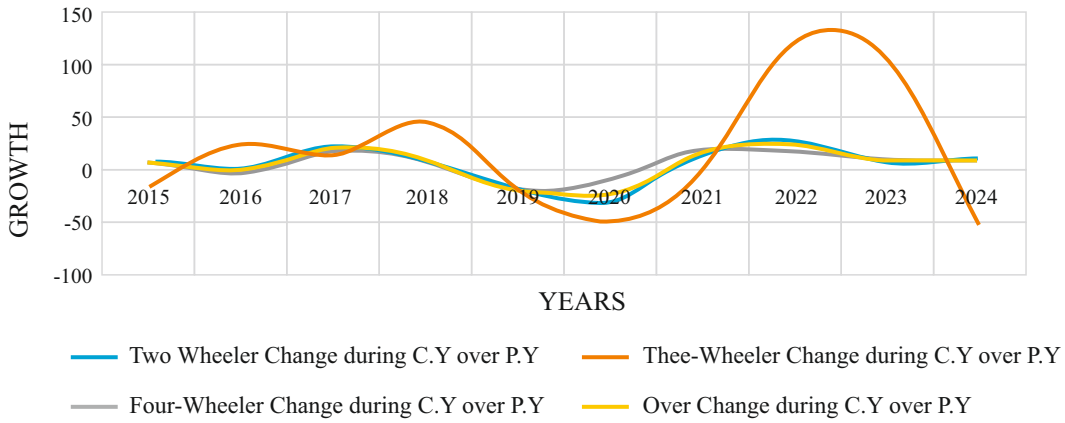
Table 5: Moving Growth of Conventional Vehicles in Dehradun (in percentage)

Year	Two-Wheeler	Three-Wheeler	Four-Wheeler	Overall
	Change during C.Y over P.Y	Change during C.Y over P.Y	Change during C.Y over P.Y	Change during C.Y over P.Y
2015	7.10188	-15.67796	7.33065	7.06306
2016	1.12157	25.12562	-3.97389	-0.17099
2017	21.3988	12.851405	16.45246	20.0769
2018	7.314878	45.90747	4.94048	6.87462
2019	-18.43985	-17.80488	-19.3712	-18.6667
2020	-29.97384	-49.25816	-8.31797	-24.7727
2021	14.69884	-5.847953	20.0819	16.22927
2022	27.411365	121.7391	17.23838	24.56144
2023	7.2210379	108.4034	9.936507	8.917452
2024	10.249	-52.956	6.473	8.478

Source: Authors' Calculation, Ministry of Road Transport & Highways, GOI

The progress in all kinds of conventional vehicles is depicted in Table 5. The table indicates that the positive development of conventional two-wheelers (NEV) was 27 percent in 2022 as compared to the year prior, 2021, followed by a 21 percent increase in 2017 over 2016. The study depicts that the registration of these vehicles is rising at a decreasing rate. Notably, a negative growth of 18 percent was observed in 2019 as opposed to the previous year, 2018. A more significant negative rate of growth of 30 percent occurred in 2020 in comparison to 2019. This decrease could be ascribed to the impact of COVID-19. A similar negative growth was noted for non-electric three-wheelers, with a 53 percent decrease in 2024 compared to 2023. For four-wheelers, a 19 percent reduction in registrations was observed in 2019 compared to 2018, and a similar trend continued in 2020, with an 8 percent decrease compared to 2019. This decrease results from the effects of COVID-19. It is determined that customers interest is shifting from NEV to EV.

Graph -4 Moving Growth of Conventional Vehicles in Dehradun



Source: Authors' Calculation, Ministry of Road Transport & Highways, GOI

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Table 6: Growth of Conventional Vehicles in Dehradun

Types	2015	2019	5-year change in 2019 over 2015	2020	2024	5-year change in 2024 over 2020	10-year change in 2024 over 2015
2-wheeler	41638	44739	0.07	31329	54374	0.74	0.31
3-wheeler	199	337	0.69	171	350	1.05	0.76
4-wheeler	15476	14643	-0.05	13425	22123	0.65	0.46

Source: Ministry of Road Transport and Highways, GOI,

Table No.6 presents the growth of conventional vehicles in Dehradun over a period of five years and ten years, i.e. from 2015-2019 and from 2020 to 2024. There were three kinds of conventional vehicles, i.e. two, three, and four wheelers. The table shows that the registrations of conventional vehicles is increasing at a lower rate in Dehradun. Additionally, it shows that the registration of all vehicles in 2024 has risen compared to 2015. This trend may be attributed to a lack of infrastructure and other essential facilities, such as quality batteries, charging stations, and repair workshops, for electric vehicles.

Findings

- The number of registrations of electric vehicles in Dehradun, Uttarakhand, was found to have fluctuated throughout the year leading up to 2024, specifically for two-wheeler and three-wheeler vehicles.

- In terms of five-year changes, there were positive increases in electric vehicle registrations from 2015 to 2019 and from 2020 to 2024. A similar trend prevailed for the ten-year changes, with increases observed in 2024 compared to 2015. Notably, a 100 percent change was recorded for electric three-wheelers and electric four-wheelers between 2015 to 2019 and between 2020 to 2024.
-
- Regarding non-electric vehicles, the changes over a decade showed that registrations of NEVs in Dehradun increased since 2015. This suggests that the lack of confidence in electric cars may stem from several incidents involving electric two-wheeler scooters.
-
- Regarding five-year and ten-year changes in NEV, there was a negative change of -0.05 in 2019 compared to 2015, while the registration of conventional four-wheelers shows a positive variation of 0.65 percent in 2024 compared to 2020. The study indicates that ten-year changes reflect positive results across all types of conventional vehicles.

Conclusion

The study concludes that most vehicle owners in Dehradun city have shifted their interest and purchasing behaviour towards electric vehicles. The reason for this shift is the growing awareness regarding the environment and the benefits of electric vehicles, which are environmentally friendly compared to non-electric cars. Infrastructure for e-vehicles is improving daily, and the availability of charging facility stations positively influences the acceptability of electric vehicles in the area. The low maintenance costs and the transition of daily expenses to a monthly basis create a favourable and relieving situation for vehicle owners.

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Suggestion

- Charging stations and maintenance facilities need to be developed. Because these facilities are lagging.
- Battery replacement facilities need to be developed.
- Detailed information for e-vehicles should be provided to the electric vehicle's purchaser.
- Free service facilities need to be provided to the vehicle's owner.

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