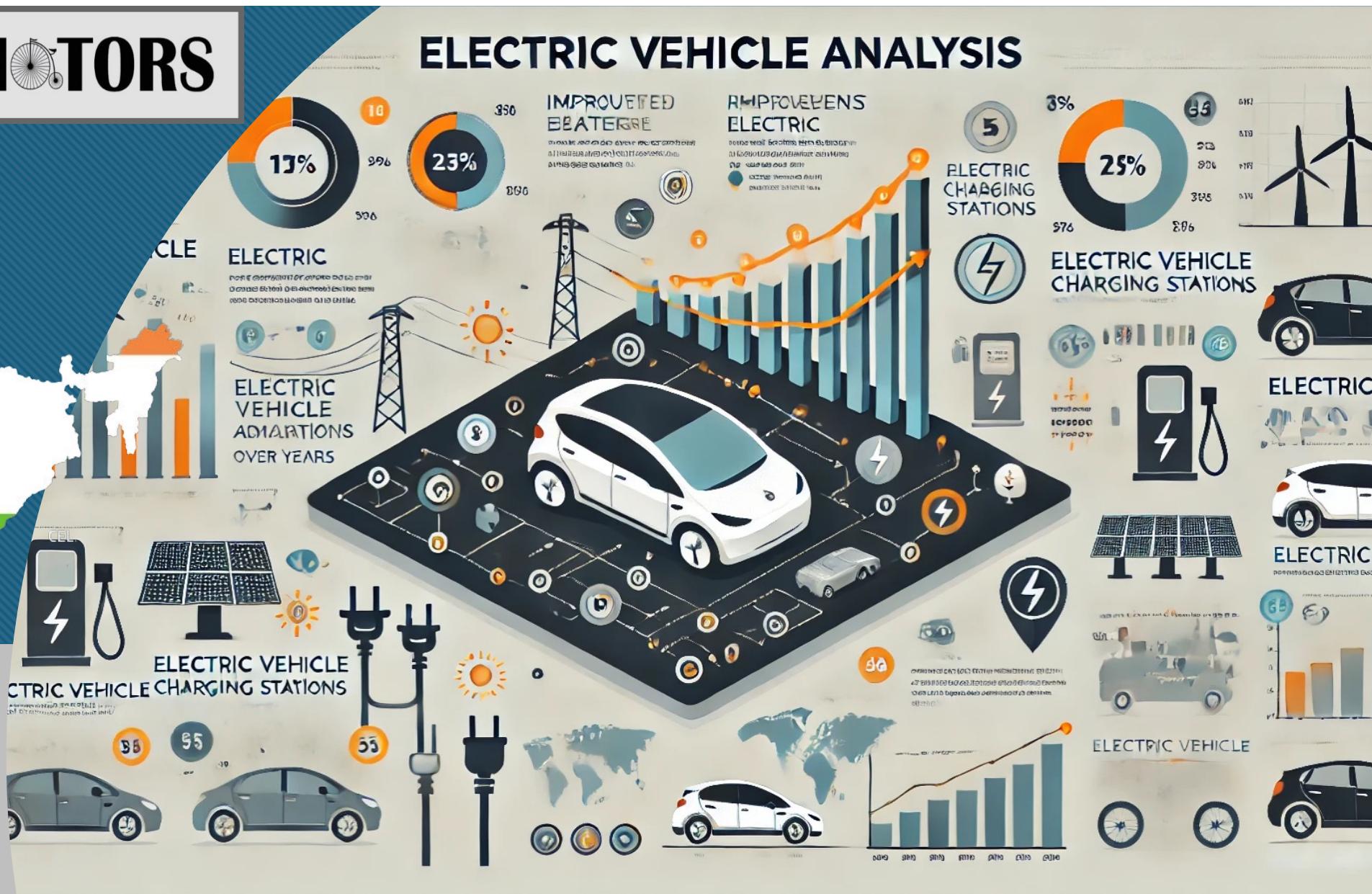




MOTORS





ELECTRIC VEHICLE ANALYSIS

CODEBASICS RESUME PROJECT CHALLENGE #12

Provide Insights to an Automotive company on Electric vehicles launch in India.

AGENDA



- Problem Statement
- Background
- Project Overview
- Data Correction and Standardization
- Primary Questions
- Dashboard Showcase
- Secondary Questions
- Insights
- Recommendations



Problem Statement



Company Overview: AtliQ Motors is a well-known company that specializes in electric and hybrid vehicles.

Current Market Presence:

Strong position in North America with a 25% market share in electric vehicles.
Currently holds less than 2% market share in India.

Expansion Plan: AtliQ Motors wants to increase its market share in India by launching its popular electric vehicle models.

Role and Objective: As a data analyst (Peter Pandey), my role is to analyze the electric and hybrid vehicle market in India.

Key Focus Areas:

- Understanding market trends.
- Studying consumer behavior.
- Evaluating infrastructure readiness.
- Analyzing the competitive landscape.

Methodology: I will use various analytical tools and follow questions provided by my manager to guide my analysis.

Goal: To create a compelling and concise presentation for Bruce Haryali, the chief of AtliQ Motors India, focusing on data-driven insights and strong storytelling.





Background



The electric vehicle (EV) market is gaining traction globally, and India, as the 4th largest automotive market, offers a great opportunity for growth. The Indian government is actively promoting electric mobility with initiatives like the FAME scheme, which provides financial incentives for both EV buyers and manufacturers.



Consumer interest in EVs is on the rise, driven by growing environmental awareness and the desire for cleaner, sustainable transportation. However, the EV market in India faces challenges, such as the need for a more robust charging infrastructure and addressing issues like high costs and range anxiety.

Despite these challenges, the potential is significant. A shift to electric vehicles could reduce pollution, lower India's dependence on oil imports, and boost the local economy by creating jobs and fostering new industries. The right strategy can tap into this potential and pave the way for a successful EV market in India.



Project Overview

Overview: The objective of this project is to analyze electric vehicle sales data across Indian states to uncover trends, identify discrepancies, and provide insights for promoting electric mobility in the country.

Datasets Overview:

This analysis uses datasets covering electric vehicle sales trends in India from April 2021 to April 2024, sourced from Codebasics with data from Vahan Sewa:

1. Electric Vehicle Sales by State: Monthly sales data categorized by vehicle type (2-Wheeler or 4-Wheeler) and state, including the date, number of EVs sold, and total vehicle sales.

2. Electric Vehicle Sales by Makers: Sales data by manufacturer, categorized by vehicle type, showing date, vehicle category, manufacturer, and number of EVs sold.

3. Date Dimension: Provides time-series analysis details, including specific dates, fiscal years, and quarters.



Data Correction and Standardization



State Names Standardization:

In the electric_vehicle_sales_by_state.csv dataset, inconsistencies were found in the naming of states. For example, "Andaman & Nicobar Island" was listed with variations. All occurrences were standardized to "Andaman & Nicobar."

Data Entry Error Correction:

In the case of Kerala for the fiscal year 2024, a discrepancy was found where for the month of January the total vehicles sold were recorded as 164, while electric vehicles sold were 734. This inconsistency suggested a data entry error. To correct this, the total vehicle count was replaced with the median of total vehicle sales values for Kerala for the fiscal year 2024 in the 4-wheeler category. The median(13,932) was chosen over the mean due to the presence of the extreme outlier (164), which would have skewed the mean value.

date	state	vehicle_category	electric_vehicles_sold	total_vehicles_sold
Saturday, April 1, 2023	Kerala	4-Wheelers	637	9771
Monday, May 1, 2023	Kerala	4-Wheelers	954	14819
Thursday, June 1, 2023	Kerala	4-Wheelers	885	14389
Saturday, July 1, 2023	Kerala	4-Wheelers	871	14002
Tuesday, August 1, 2023	Kerala	4-Wheelers	736	18189
Friday, September 1, 2023	Kerala	4-Wheelers	773	21467
Sunday, October 1, 2023	Kerala	4-Wheelers	642	14522
Wednesday, November 1, 2023	Kerala	4-Wheelers	641	12551
Friday, December 1, 2023	Kerala	4-Wheelers	736	13811
Monday, January 1, 2024	Kerala	4-Wheelers	734	164
Thursday, February 1, 2024	Kerala	4-Wheelers	684	12281



PRIMARY QUESTIONS

1. LIST THE TOP 3 AND BOTTOM 3 MAKERS FOR THE FISCAL YEARS 2023 AND 2024 IN TERMS OF THE NUMBER OF 2-WHEELER SOLD.



TOP 3 MAKERS IN 2023

Makers	EV Sold
OLA ELECTRIC	152,583
OKINAWA	96,945
HERO ELECTRIC	88,993

TOP 3 MAKERS IN 2024

Makers	EV Sold
OLA ELECTRIC	322,489
TVS	180,743
ATHER	107,552

Ola Electric consistently leads in 2-wheeler sales for both 2023 and 2024, with significant growth from 152,583 to 322,489 units. Meanwhile, TVS and Ather entered the top 3 in 2024, indicating a shift in market dynamics.



1. LIST THE TOP 3 AND BOTTOM 3 MAKERS FOR THE FISCAL YEARS 2023 AND 2024 IN TERMS OF THE NUMBER OF 2-WHEELER SOLD.



BOTTOM 3 MAKERS IN 2023

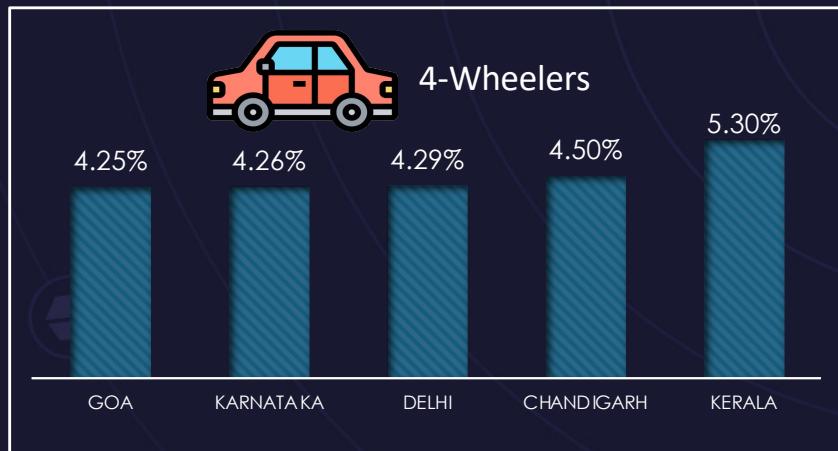
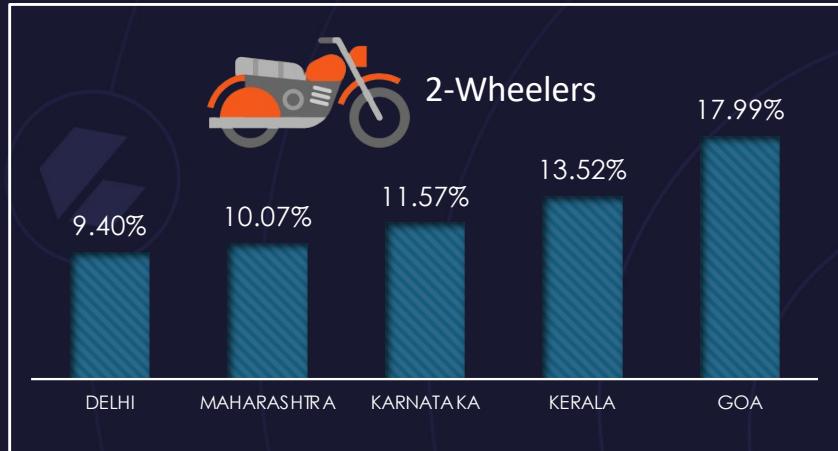
Makers	EV Sold
JITENDRA	8,563
BEING	11,018
PURE EV	11,556

BOTTOM 3 MAKERS IN 2024

Makers	EV Sold
BATTRE ELECTRIC	4,841
REVOLT	7,254
KINETIC GREEN	9,585



2. IDENTIFY THE TOP 5 STATES WITH THE HIGHEST PENETRATION RATE IN 2-WHEELER AND 4-WHEELER EV SALES IN FY 2024.



PENETRATION RATE

It represents the percentage of total vehicles that are electric within a specific region, time or category.

$$\text{Penetration Rate\%} = \frac{\text{Electric Vehicles Sold}}{\text{Total Vehicles Sold}} \times 100$$

Note: The 4-wheeler sales result for Kerala in FY 2024 shows a slight deviation from the expected 5.76% due to a data correction in the total vehicle sales for January.



3. LIST THE STATES WITH NEGATIVE PENETRATION (DECLINE) IN EV SALES FROM 2022 TO 2024.



STATE WITH DECLINING 2-WHEELER EV PENETRATION RATE
FROM 2022 TO 2024

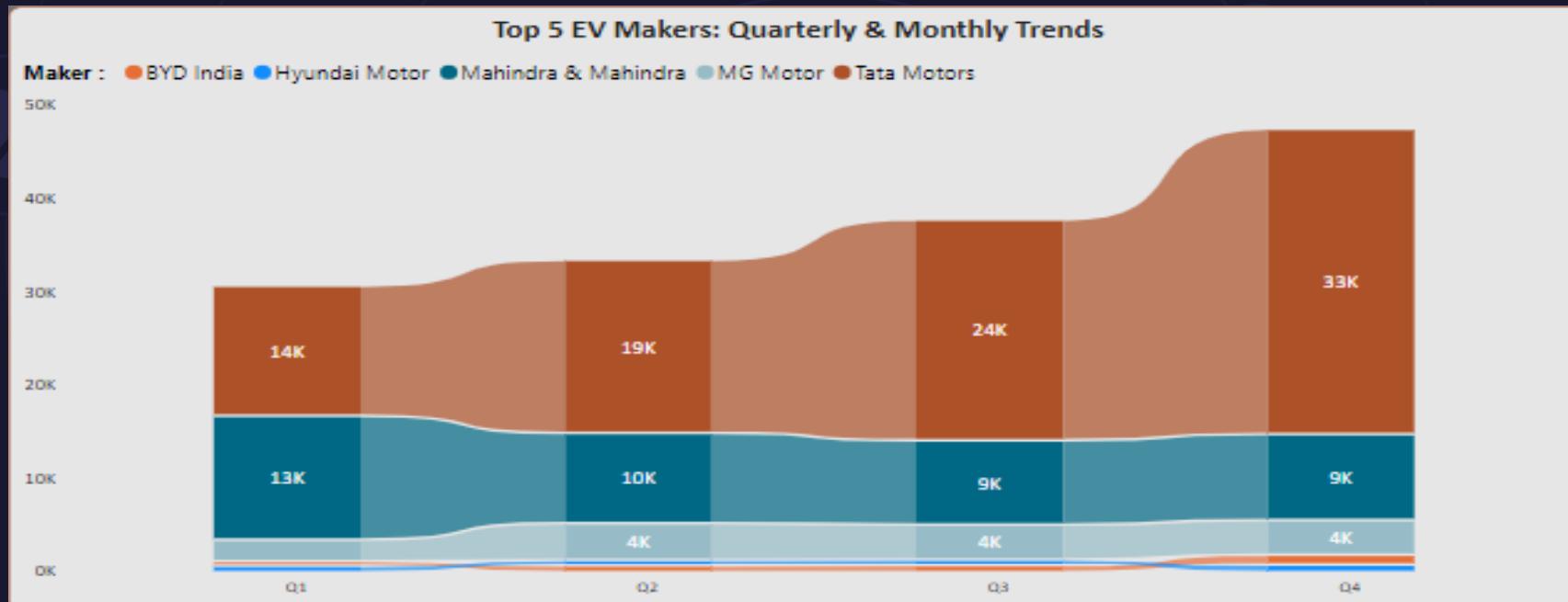
States	LADAKH
2022: EV Penetration Rate%	4.48%
2024: EV Penetration Rate%	4.06%
2022-2024: EV Penetration Rate Decline	-0.41%



STATE WITH DECLINING 4-WHEELER EV PENETRATION RATE
FROM 2022 TO 2024

States	ANDAMAN & NICOBAR
2022: EV Penetration Rate%	1.88%
2024: EV Penetration Rate%	0.77%
2022-2024: EV Penetration Rate Decline	-1.11%

4. WHAT ARE THE QUARTERLY TRENDS BASED ON SALES VOLUME FOR THE TOP 5 EV MAKERS (4-WHEELERS) FROM 2022 TO 2024?



consistently leads in sales volume for four-wheelers every quarter.

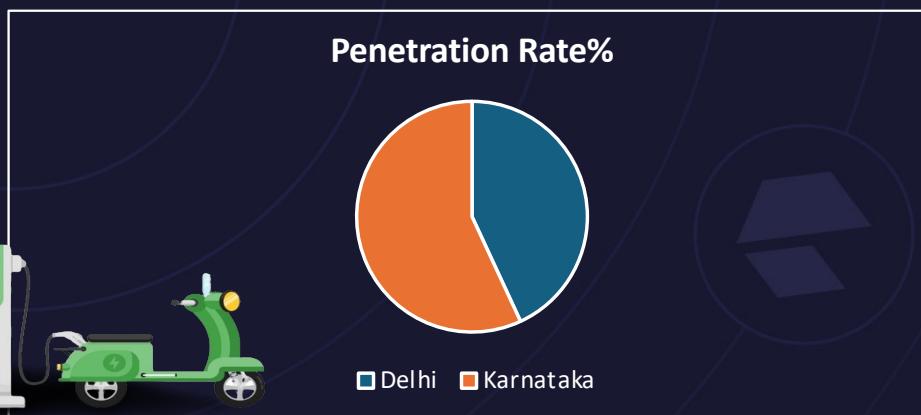
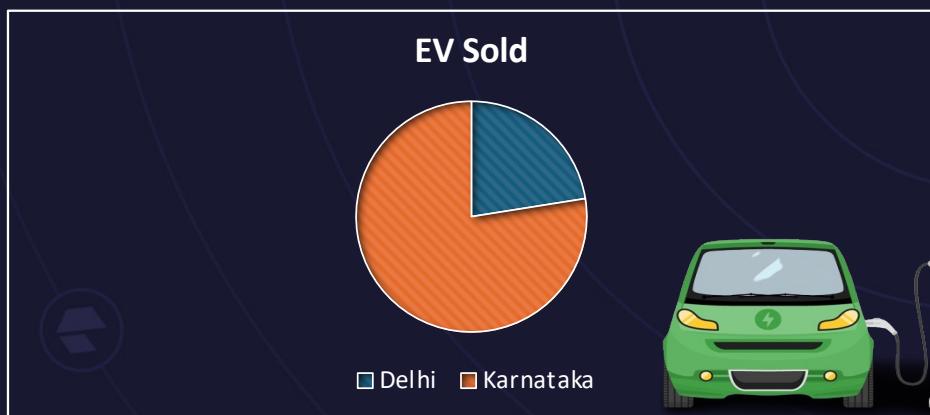




5. HOW DO THE EV SALES AND PENETRATION RATES IN DELHI COMPARE TO KARNATAKA FOR 2024

States	DELHI
EV Sold	46,724
2024: EV Penetration Rate%	7.71%

States	KARNATAKA
Ev Sold	160,989
2024: EV Penetration Rate%	10.18%



6. LIST DOWN THE COMPOUNDED ANNUAL GROWTH RATE (CAGR) IN 4-WHEELER UNITS FOR THE TOP 5 MAKERS FROM 2022 TO 2024.



Makers	EV SOLD
TATA MOTORS	88,935
MAHINDRA & MAHINDRA	41,193
MG MOTOR	13,753
BYD INDIA	2,419
HYUNDAI MOTOR	2,076

The Compound Annual Growth Rate (CAGR) is a useful measure to understand the mean annual growth rate of an investment or a business metric over a specified period, provided the **period is more than one year**.

$$\text{CAGR} = \left(\frac{\text{Ending Value}}{\text{Beginning Value}} \right)^{\frac{1}{n}} - 1$$

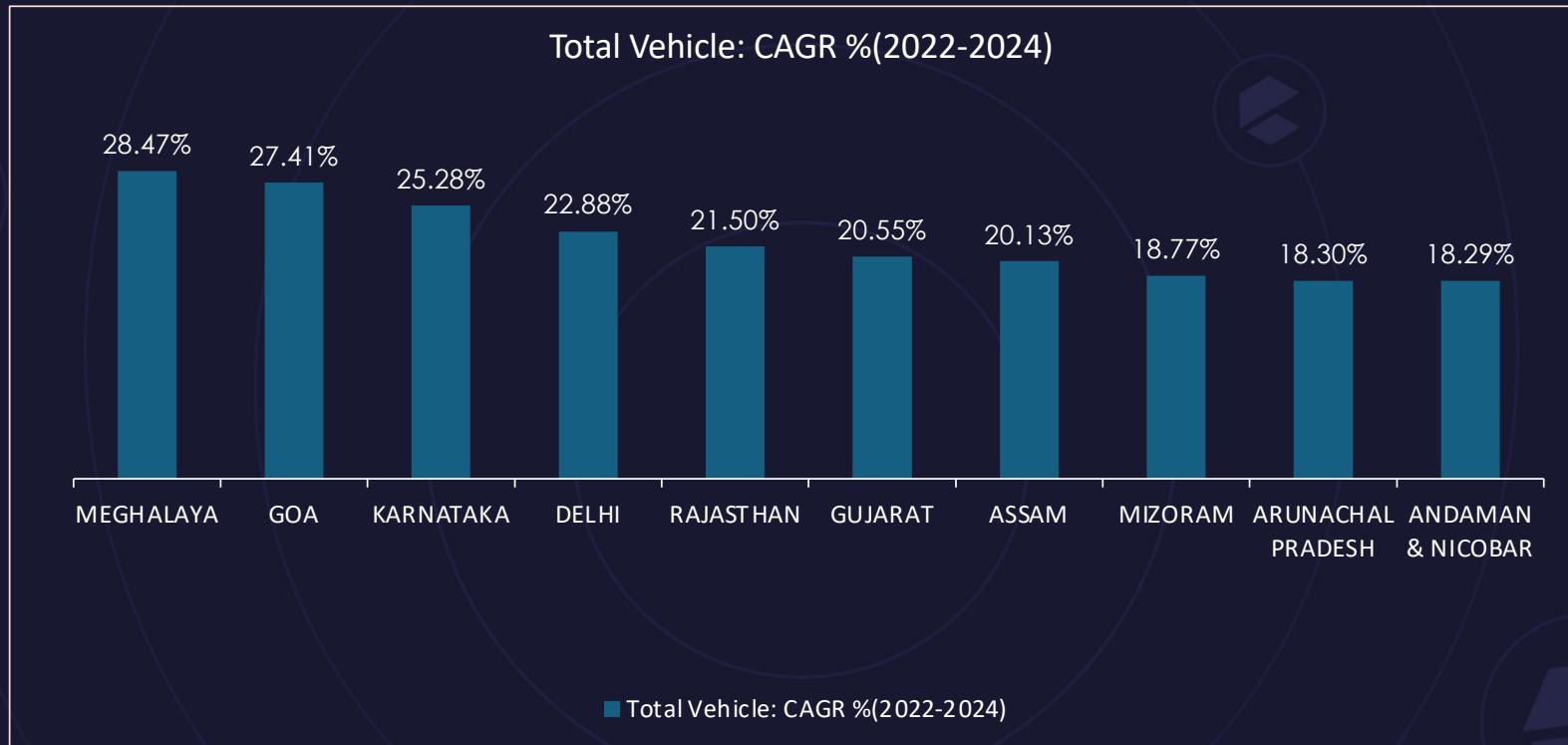
Where:

- **Ending Value:** The value of the investment at the end of the period.
- **Beginning Value:** The value of the investment at the start of the period.
- **n:** The number of years over which the growth is being measured.





7. List down the top 10 states that had the highest compounded annual growth rate (CAGR) from 2022 to 2024 in total vehicles sold.





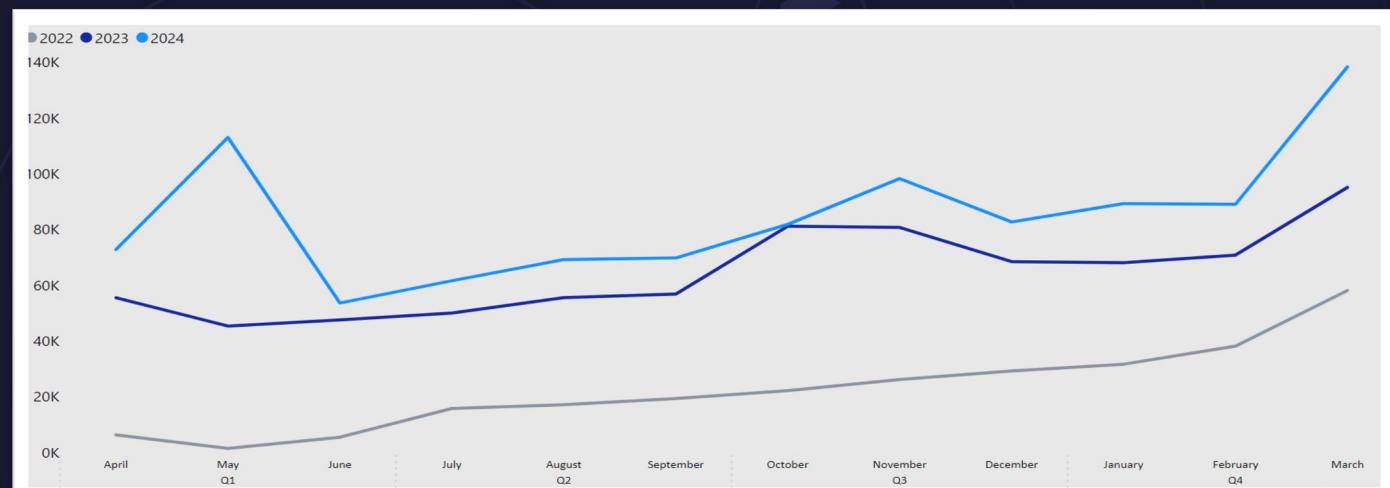
8. WHAT ARE THE PEAK AND LOW SEASON MONTHS FOR EV SALES BASED ON THE DATA FROM 2022 TO 2024?

TOTAL EV SOLD FROM 2022 TO 2024 BY QUARTER & MONTH



Season	Month	EV Sold
Peak Season	March	291,587
Low Season	June	106,709

TOTAL EV SOLD IN 2022, 2023 AND 2024 BY QUARTER & MONTH



Season	2022: Month	2022: EV Sold	2023: Month	2023: EV Sold	2024: Month	2024: EV Sold
PEAK SEASON	MARCH	58,118	MARCH	95,126	MARCH	138,343
LOW SEASON	MAY	1,499	MAY	45,373	JUNE	53,631

9. WHAT IS THE PROJECTED NUMBER OF EV SALES (INCLUDING 2-WHEELERS AND 4-WHEELERS) FOR THE TOP 10 STATES BY PENETRATION RATE IN 2030, BASED ON THE COMPOUNDED ANNUAL GROWTH RATE (CAGR) FROM PREVIOUS YEARS?



States	EV: Penetration Rate%	EV: CAGR%(2022-2024)	EV: Projected Sales (2030)
MEGHALAYA	2969.08%	476.63%	4,889,074
KERALA	2138.91%	132.83%	11,779,401
CHANDIGARH	1198.68%	164.58%	986,811
GOA	720.30%	146.45%	2,419,574
CHHATTISGARH	660.64%	150.89%	7,118,219
MANIPUR	660.52%	124.50%	16,131
TRIPURA	449.18%	229.50%	389,063
WEST BENGAL	311.20%	150.62%	4,178,395
MADHYA PRADESH	232.62%	133.67%	7,036,266
MAHARASHTRA	223.34%	101.89%	13,351,146

Note: The projected sales data is based on historical trends and may change due to shifts in government policies, social factors, economic conditions, and other variables.



10. ESTIMATE THE REVENUE GROWTH RATE OF 4-WHEELER AND 2-WHEELER EVs IN INDIA FOR 2022 VS 2024 AND 2023 VS 2024, ASSUMING AN AVERAGE UNIT PRICE.

Vehicle_category	Average Price
2-Wheelers	₹ 85,000.00
4-Wheelers	₹ 15,00,000.00



EV REVENUE
GROWTH%
(2023-2024)
83.08%

EV:
REVENUE
GROWTH
RATE%

4-Wheelers

EV REVENUE
GROWTH%
(2022-2024)
367.79%

10. ESTIMATE THE REVENUE GROWTH RATE OF 4-WHEELER AND 2-WHEELER EVs IN INDIA FOR 2022 VS 2024 AND 2023 VS 2024, ASSUMING AN AVERAGE UNIT PRICE.



Vehicle_category	Average Price
2-Wheelers	₹ 85,000.00
4-Wheelers	₹ 15,00,000.00



EV: REVENUE
GROWTH
RATE%

2-Wheelers

EV REVENUE
GROWTH%
(2023-2024)
28.13%

EV REVENUE
GROWTH%
(2022-2024)
269.28%



DASHBOARD SHOWCASE



SECONDARY QUESTIONS

1.WHAT ARE THE PRIMARY REASONS FOR CUSTOMERS CHOOSING 4-WHEELER EVS IN 2023 AND 2024 (COST SAVINGS, ENVIRONMENTAL CONCERNs, GOVERNMENT INCENTIVES)?



Cost Savings:

- **Lower Operating Costs:** EVs are appealing due to their lower operating costs compared to traditional internal combustion engine (ICE) vehicles. The savings come from cheaper electricity versus fuel costs and reduced maintenance requirements, as EVs have fewer moving parts.
- **Government Incentives:** The Indian government's initiatives, particularly the FAME II subsidy, provide up to ₹1.5 lakhs in incentives, significantly lowering the initial purchase cost of EVs. Additionally, states like Maharashtra, Delhi, and Gujarat offer extra benefits such as tax exemptions and reduced

Environmental Concerns:

- **Reduction in Carbon Emissions:** With increasing awareness of climate change, consumers are more conscious of their environmental impact. EVs produce zero tailpipe emissions, which helps in reducing air pollution, especially in urban areas where air quality is a major concern.
- **Government Support for Clean Energy:** The Indian government's commitment to reducing greenhouse gas emissions aligns with global efforts to combat climate change, encouraging consumers to switch to cleaner energy alternatives like EVs.





Technological Advancements and Infrastructure:

- **Improved Range and Charging Infrastructure:** The range of entry-level EVs has improved, now offering around 200-300 km per charge, sufficient for most daily commutes. While the number of public charging stations in India is growing, with around 1,500 stations as of August 2024, the majority are concentrated in urban areas. The expansion of charging infrastructure is reducing range anxiety, making EVs a more practical choice.
- **Innovation and Competition:** The EV market is becoming increasingly competitive, with established players like Tata Motors, MG Motors, and Mahindra leading innovation. This competition drives advancements in battery technology and vehicle performance, making EVs more attractive.

Corporate Social Responsibility (CSR):

- **Corporate Adoption of EVs:** Many companies in India are integrating EVs into their CSR strategies, focusing on sustainability. This trend not only supports environmental goals but also influences consumer preferences, as more people choose EVs for both personal and environmental reasons.

State-Specific Benefits:

- **Regional Incentives:** States like Maharashtra, Delhi, and Gujarat offer additional financial benefits, such as registration fee waivers and road tax exemptions. These state-specific incentives make EVs even more financially viable for consumers in these regions.



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2. HOW DO GOVERNMENT INCENTIVES AND SUBSIDIES IMPACT THE ADOPTION RATES OF 2-WHEELERS AND 4-WHEELERS? WHICH STATES IN INDIA PROVIDED THE MOST SUBSIDIES?

Government Incentives and Impact on EV Adoption:

Key Schemes:

NEMMP (National Electric Mobility Mission Plan): Promotes EV adoption through financial incentives and infrastructure support.

FAME India Scheme: Provides subsidies for electric vehicles to reduce their cost and encourage adoption.

EMPS (Electric Mobility Promotion Scheme): Offers additional subsidies and supports EV infrastructure, including charging stations.

Recent Updates:

Extended Subsidies: Financial support for electric two-wheelers and three-wheelers has been extended until September 2023.

GST Reductions: GST on electric vehicles reduced from 12% to 5%, and on EV charging stations from 18% to 5%.

Top Subsidy State:

Maharashtra: Provides the highest subsidies for electric vehicles, reflecting strong state-level support for EV adoption.



Here's a table summarizing the impact of government incentives and subsidies on EV adoption across 3 top states in India which provide most subsidies:

State	Incentives for 2-Wheelers	Incentives for 3-Wheelers	Incentives for 4-Wheelers	Registration fees and Road Tax Waiver	Adoption Goal/Impact
MAHARASHTRA	10,000	30,000	1.5 Lakhs	Yes	25% of buses converted to electric strong state-level support.
DELHI	15,000	30,000	1.5 Lakhs	Yes	25% of new vehicle registrations to be electric by 2025.
GUJARAT	20,000	50,000	1.5 Lakhs	No	Will witness around 2 Lakhs EV on road.

3. HOW DOES THE AVAILABILITY OF CHARGING STATIONS INFRASTRUCTURE CORRELATE WITH THE EV SALES AND PENETRATION RATES IN THE TOP 5 STATES?

States	2024: EV Sold	2024: Penetration Rate %	2024: PCS
MAHARASHTRA	197,169	8.60%	3,079
KARNATAKA	160,989	10.18%	1,041
TAMIL NADU	94,314	5.49%	643
GUJARAT	84,359	5.30%	476
KERALA	73,938	11.34%	852

PCS: Public Charging Stations

2024: CORRELATION COEFFICIENT OF CHARGING STATIONS AND
EV SOLD
0.83

2024: CORRELATION COEFFICIENT OF CHARGING STATIONS AND
PENETRATION RATE
0.53



Mahendra Singh Dhoni

4. WHO SHOULD BE THE BRAND AMBASSADOR IF ATLIQ MOTORS LAUNCHES THEIR EV/HYBRID VEHICLES IN INDIA AND WHY?



- **Wide Appeal and Popularity:** Dhoni, known as "Captain Cool," is one of India's most beloved sports figures. His leadership, calm demeanor, and cricketing success make him a highly recognizable and trusted figure, which can greatly enhance brand recall and trust for AtliQ Motors.
- **Positive Image:** Dhoni's disciplined and responsible persona aligns with the values of sustainability and innovation central to the EV/Hybrid vehicle market.
- **Influence on Youth:** With a significant following among the younger demographic, Dhoni can effectively drive awareness and adoption of EV/Hybrid vehicles among those who are increasingly interested in sustainable solutions.
- **High Credibility:** Dhoni's credibility and respect lend authority to AtliQ Motors' EV/Hybrid vehicles, reinforcing the brand's commitment to quality and sustainability.
- **Alignment with Green Initiatives:** His involvement in charitable and environmental causes mirrors the eco-friendly nature of EV/Hybrid vehicles, enhancing the brand's image as a promoter of positive change.

5. WHICH STATE OF INDIA IS IDEAL TO START THE MANUFACTURING UNIT? (BASED ON SUBSIDIES PROVIDED, EASE OF DOING BUSINESS, STABILITY IN GOVERNANCE, ETC.)

INSIGHTS

Gujarat:



- **Significant Subsidies:** Offers substantial subsidies for two-wheelers, three-wheelers, and four-wheelers.
- **Business-Friendly Environment:** Known for its ease of doing business and supportive industrial policies.
- **Strong Infrastructure:** Well-developed infrastructure and commitment to expanding EV infrastructure.

Maharashtra:



- **Substantial Incentives:** Provides significant incentives for various EV categories and waives registration fees and road taxes.
- **Robust Industrial Base:** Has a strong industrial infrastructure and a high level of EV adoption and conversion targets.
- **Government Support:** Active government initiatives and subsidies support EV growth and manufacturing.

RECOMMENDATIONS

6. YOUR TOP 3 RECOMMENDATIONS FOR ATLIQ MOTORS:

1. **Choose Gujarat for manufacturing:** Establish the manufacturing unit in Gujarat due to its significant subsidies, business-friendly environment, and well-developed infrastructure. Additionally, target high-growth states like Maharashtra, Karnataka, and Gujarat, which have strong EV adoption rates and government support.
2. **Expand charging infrastructure:** Collaborate with local entities to expand public charging stations, starting in high-revenue cities. Focus on building a comprehensive EV ecosystem, including a network of charging stations and integrated services, to enhance the overall customer experience.
3. **Invest in affordable two-wheelers:** Concentrate on producing affordable two-wheeler EVs with enhanced features, as this segment is highly popular. Consider acquiring small EV manufacturing companies to reduce infrastructure costs and facilitate market entry, while leveraging available government incentives and support.





Thank you to the Codebasics team
for organizing this competition, and
thanks to everyone for listening to
my presentation.

ELECTRIC VEHICLE ANALYSIS

FUTURE IS ELECTRIC

