

# **ANALYSING THE FUTURE OF AUTOMOBILES**

CHARTING NEW ROUTES, REDUCING OUR POLLUTES



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\*Issue tree theme

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# INTRODUCTION

This deck delves into the three leading contenders in the race for a greener future: Battery Electric Vehicles (BEVs), Green Fuel Vehicles, and Hybrid Vehicles.

## **BEVs**

Fully electric vehicles.

## **Green Fuel Vehicles**

Vehicles running on alternative fuels such as CNG, LNG, biofuels, or hydrogen.

## **Hybrid Vehicles**

Vehicles combining internal combustion engines with electric motors.



# ENVIRONMENTAL IMPACT

## Through Guesstimate

Considering the passenger car segment

Total number of cars globally (2024 report) = **1.5 billion** (approx)

**No. of fleets of type** = 1.5 billion \* Global Market Share of type

**CO2 emission of type** = No. of fleets of type \* lifetime CO2 emission

Type	Global Market Share	Lifetime CO2 Emission	No. of Fleets globally (billions)	CO2 Emission (billion tons)
ICEVs	55%	20 tons	0.825	16.5
HEVs	20%	15 tons	0.3	4.5
Green Fuel	2%	15 tons	0.03	0.45
EVs	18%	10 tons	0.27	2.7

\*the numbers are not 100% precise

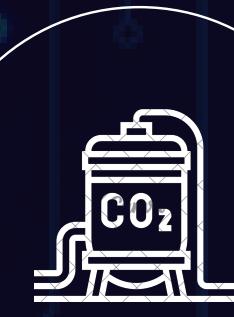
**Total CO2 Emission = 24.15 billion tons**

This implies that with the current no. of fleets 24.15 billion tons of CO2 is going to be produced.

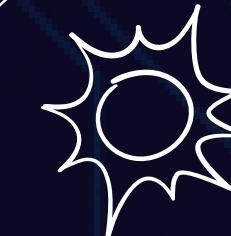
# Impact Analysis of this 24.15 billion ton CO<sub>2</sub>



Removing this lot of CO<sub>2</sub> requires roughly **68.7 billion trees**



The cost of **CCS(Carbon Capture and Storage)** to offset the environmental impact range from **966 to 2415 billion dollars**



This can increase the global temperature significantly leading to even alarming threat of **global warming**



It is roughly **215 times** the CO<sub>2</sub> released in 2020 California wildfires



This lot of CO<sub>2</sub> can decrease the ocean pH by **0.1-0.3 units**



This is the situation when we consider passenger car segment only. The impact of other automobiles adds a drastic impact.

Also, this is the situation when we consider only the automobiles present at this date but obviously in future we are going to have more of them.  
**Therefore, the automobile sector has a huge impact on environment.**

Did you notice that the **Internal Combustion Engine (ICE) Vehicles** contributes **68.32%** to the total CO<sub>2</sub> emission. Also it produces fairly high amount of CO<sub>2</sub> in its lifetime.

**This signifies the need to shift to the cleaned automobile types.**

# LIFECYCLE EMISSION

BEV

- **Production:** High emissions due to battery manufacturing.
- **Operation:** Zero tailpipe emissions, dependent on the electricity source.
- **Disposal:** Battery recycling issues.

GFV

- **Production:** Emissions vary by fuel type; CNG and hydrogen production can be energy-intensive.
- **Operation:** Lower CO<sub>2</sub> emissions compared to gasoline/diesel. CNG emits less CO<sub>2</sub>; hydrogen emits only water vapor.
- **Disposal:** Less problematic than batteries, but infrastructure for fuel is required.

HEV

- **Production:** Moderate emissions, combining battery and engine manufacturing.
- **Operation:** Lower emissions than ICE due to improved fuel efficiency and electric assistance.
- **Disposal:** Similar to ICE but with additional battery recycling considerations.



# >>> COMPARISON

*with respect to India*

Features	BEVs	HEVs	Green Fuel Alternatives
<b>Environmental Impact</b> 	Least impact	Low but higher than BEVs	Varies (depending on feedstock) but lower than ICEVs
<b>Running Cost</b> 	Low	Lower than GFA but higher than BEVs	CNG - Lower; Biofuels - depending on feedstock price
<b>Efficiency</b> 	High energy conversion rate	Improved but lower than BEVs	Varies (similar to gasoline)
<b>Range Anxiety</b> 	Yes, limited charging infrastructure	No anxiety	No anxiety
<b>Government Incentives</b> 	Significant subsidies and tax breaks	Typically not available	May be available for CNG vehicles in some regions
<b>Availability of Models</b> 	Two wheelers: wide range Four-wheelers: increasing	Limited model selection	CNG - Readily available Biofuels - Limited availability

# COST ANALYSIS

1



## BATTERY ELECTRIC VEHICLES

### Purchasing Price:

- Initial Cost: Higher than ICE and hybrids due to battery costs.
- Example: ₹15-20 lakhs for mid-range models in India.

### Maintenance Cost:

- Lower due to fewer moving parts.
- Estimated Annual Cost: ₹5,000-10,000.

### Operational Expenses:

- Electricity Cost: ₹1-2 per km.
- Total Lifetime Fuel Cost: Lower than ICE and hybrids due to cheaper electricity.
- Example: ₹2-4 lakhs over 8-12 years.

### Road Taxes:

- Often lower or waived to promote adoption.
- Example: ₹0-50,000 [varies by state].

### Net Cost of Ownership:

- Higher initial cost offset by lower running and maintenance costs.
- Example: ₹17-22 lakhs over 8-12 years.



## HYBRID ELECTRIC VEHICLES

### Purchasing Price:

- Initial Cost: Higher than ICE but lower than BEVs.
- Example: ₹12-18 lakhs for mid-range models.

### Maintenance Cost:

- Moderate due to dual systems (engine and battery).
- Estimated Annual Cost: ₹10,000-15,000.

### Operational Expenses:

- Fuel Cost: ₹4-6 per km.
- Total Lifetime Fuel Cost: Lower than ICE, higher than BEVs.
- Example: ₹5-8 lakhs over 10-15 years.

### Road Taxes:

- Generally standard rates, with occasional incentives.
- Example: ₹50,000-1 lakh [varies by state].

### Net Cost of Ownership:

- Balanced between initial cost and running expenses.
- Example: ₹18-24 lakhs over 10-15 years.



## GREEN FUEL ALTERNATIVES

### Purchasing Price:

- Initial Cost: Comparable to or slightly higher than ICE.
- Example: ₹8-15 lakhs for mid-range models.

### Maintenance Cost:

- Comparable to ICE, with specific fuel system maintenance.
- Estimated Annual Cost: ₹7,000-12,000.

### Operational Expenses:

- Fuel Cost: Varies by type (CNG: ₹3-5 per km, Hydrogen/Biofuels vary).
- Total Lifetime Fuel Cost: Varies (CNG cheaper).
- Example: ₹3-6 lakhs over 10-15 years.

### Road Taxes:

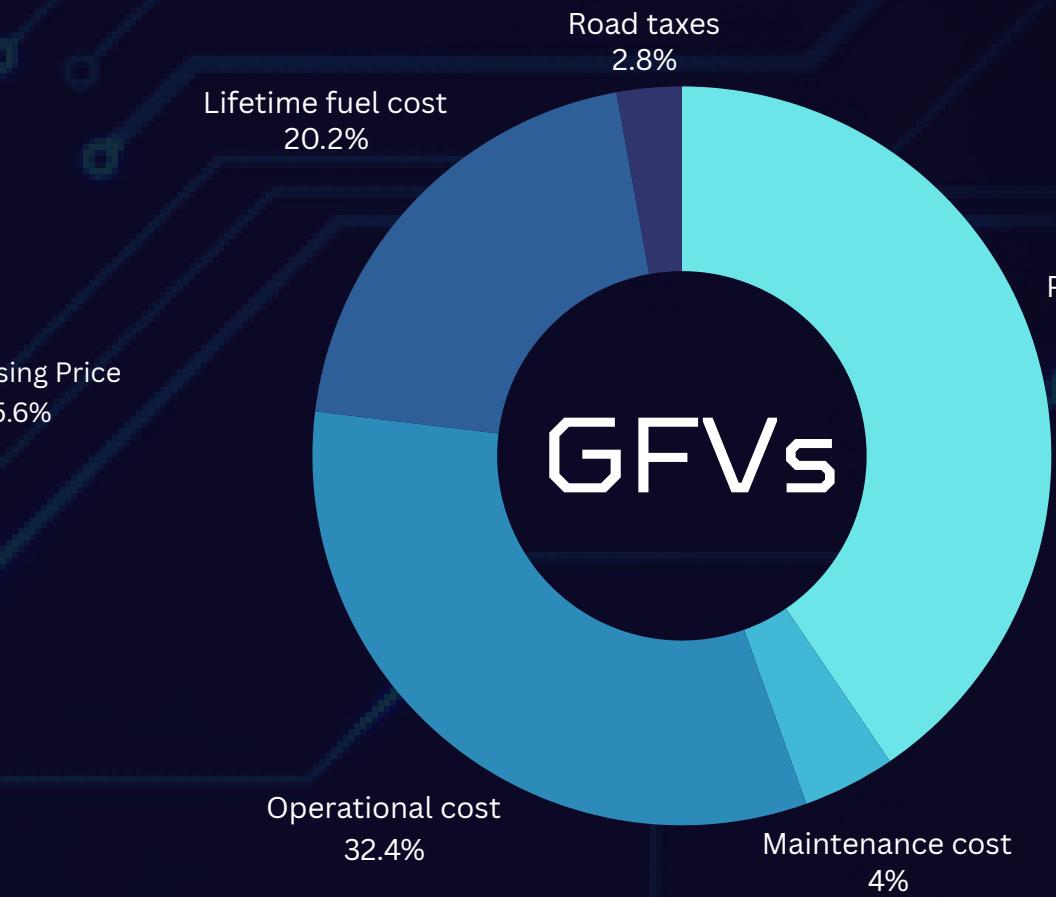
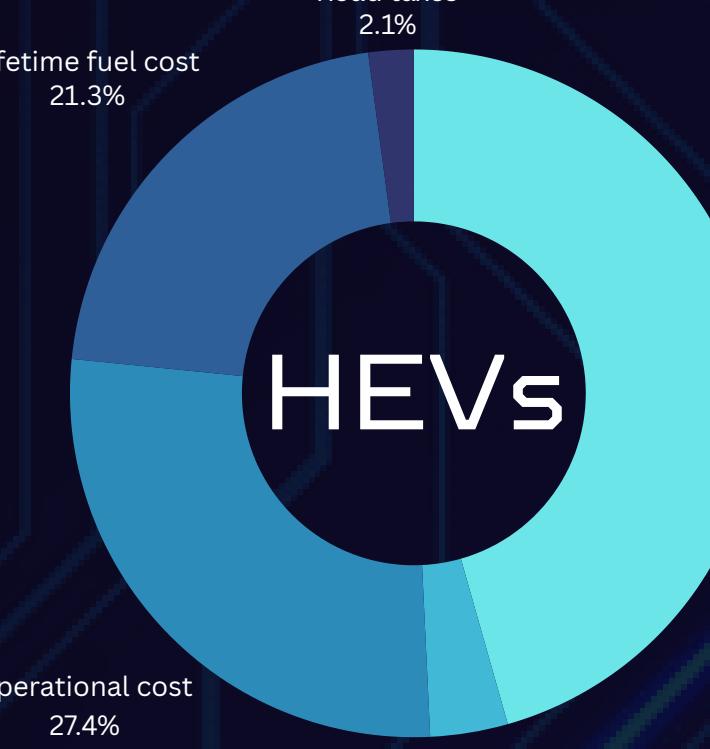
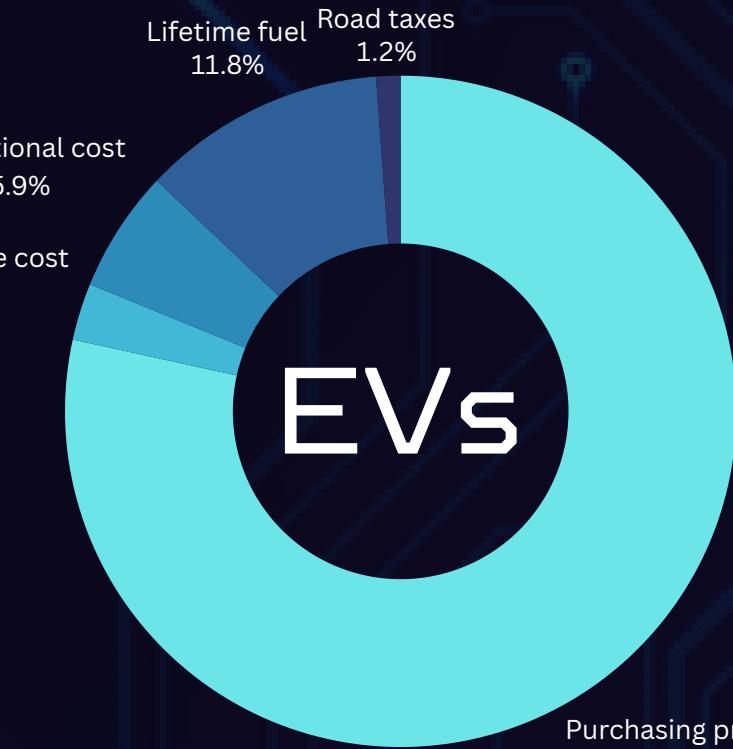
- Generally standard rates, with occasional incentives for green fuels.
- Example: ₹50,000-1 lakh [varies by state].

### Net Cost of Ownership:

- Varies significantly by fuel type and local fuel prices.
- Example: ₹12-20 lakhs over 10-15 years.

\*Cost estimation for India

Aspect	BEVs	HEVs	VS Green Fuel Vehicles
Purchasing Price 	₹15-20 lakhs	₹12-18 lakhs	₹8-15 lakhs
Maintenance Cost 	₹5,000-10,000/year	₹10,000-15,000/year	₹7,000-12,000/year
Operational Cost 	₹1-2/km (electricity)	₹4-6/km (fuel)	₹3-5/km (CNG)
Lifetime Fuel Cost 	₹2-4 lakhs	₹5-8 lakhs	₹3-6 lakhs
Road Taxes 	₹0-50,000	₹50,000-1 lakh	₹50,000-1 lakh
Net Ownership Cost 	₹17-22 lakhs	₹18-24 lakhs	₹12-20 lakhs
Lifespan 	8-12 years	10-15 years	10-15 years



## COST BREAKDOWN

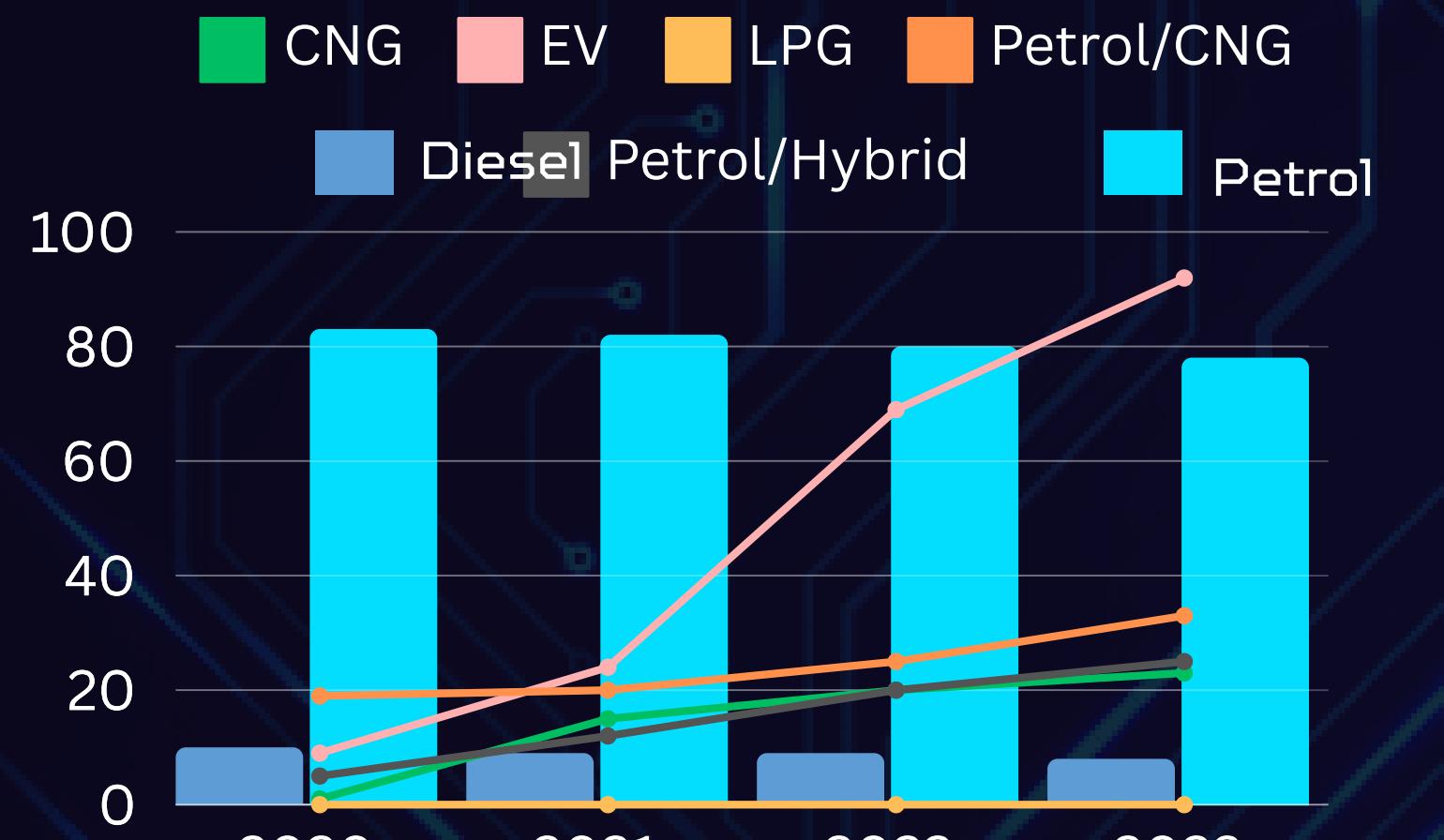
Purchasing price =  
**88-91%** Total ownership  
expenses

Purchasing price =  
**67-75%** Total ownership  
expenses

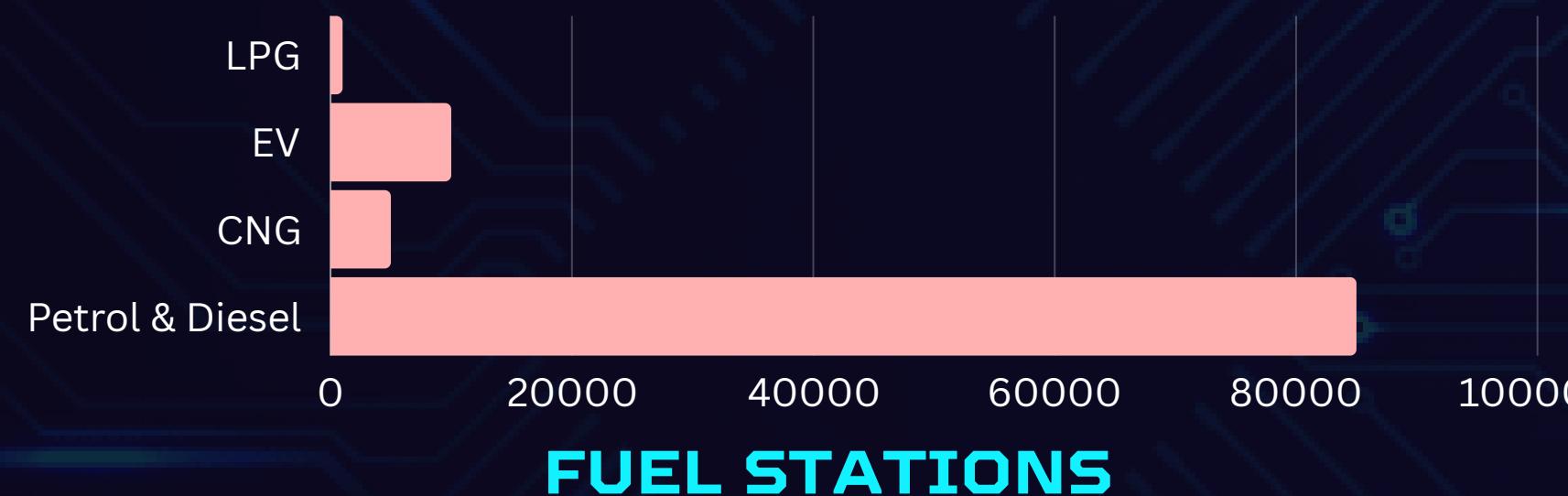
Purchasing price =  
**67-75%** Total ownership  
expenses

- BEVs have higher initial costs but lower operational and maintenance expenses, making them **cost-effective over time**, especially with incentives.
- HEVs offer a middle ground with moderate costs and improved efficiency over ICEs.
- **Green Fuel Vehicles** provide varied benefits depending on the specific fuel used, generally offering lower operational costs than ICEs.

# INDIAN MARKET TREND



## CHANGING TREND OF VEHICLE SALES



## PRICE RANGE AND SALES

### BEVs

#### PRICE RANGE

- Two-Wheelers:
  - Available Range: ₹ 60,000 - ₹ 1.5 lakh
  - Maximum Sales Range: ₹ 60,000 - ₹ 1 lakh
- Four-Wheelers:
  - Available Range: ₹ 5 lakh - ₹ 20 lakh and upwards
  - Maximum Sales Range: ₹ 5 lakh - ₹ 10 lakh

#### SALES DATA

- India Sales:
  - 2023: ~5,00,000 units (including two and four-wheelers)
  - Expected 2024: ~7,50,000 units
- Market Share:
  - 2023: 2%
  - Expected 2024: 3.5%

## HEVs

### PRICE RANGE

- Four-Wheelers:
  - Available Range: ₹10 lakh - ₹15 lakh
  - Maximum Sales Range: enough data not available

### SALES DATA

- India Sales:
  - 2023: ~50,000 units
  - Expected 2024: ~75,000 units
- Market Share:
  - 2023: 1%
  - Expected 2024: 1.5%



## INSIGHTS

**BEVs:** Having maximum sales in affordable range and has a significant growth with expectation of rapid growth.

**HEVs:** Has limited growth and expected to rise further.

**GFAAs:** Popular among budget-conscious people and maintaining a stable market share & projected to grow in future.

## GFAAs(CNG)

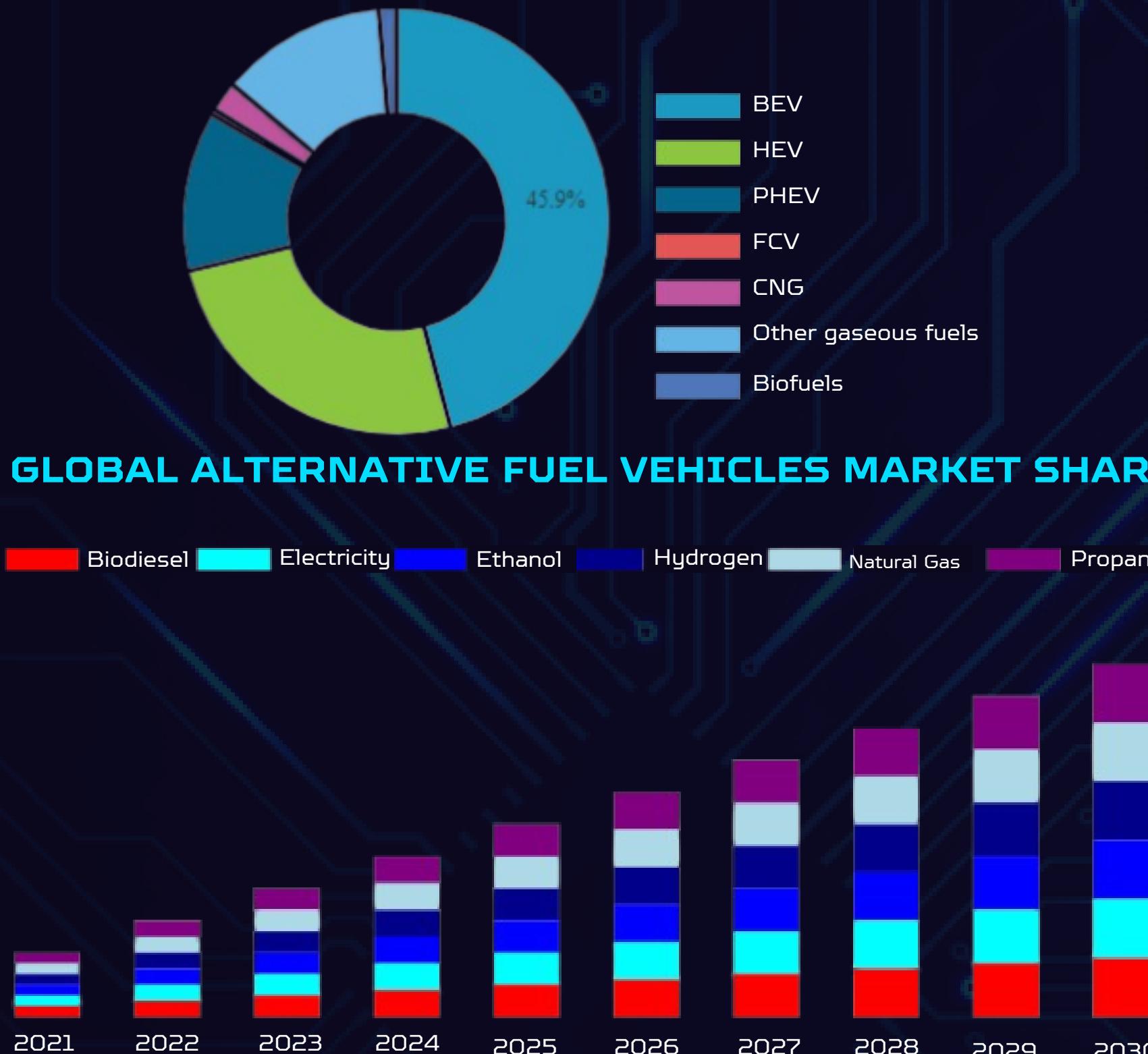
### PRICE RANGE

- Four-Wheelers:
  - Available Range: ₹ 5 lakh - ₹ 16 lakh
  - Maximum Sales Range: ₹ 6 lakh - ₹ 10 lakh

### SALES DATA

- India Sales:
  - 2023: ~3,00,000 units
  - Expected 2024: ~4,00,000 units
- Market Share:
  - 2023: 6%
  - Expected 2024: 7.5%

# GLOBAL MARKET TREND



## PRICE RANGE AND SALES

### BEVs

#### PRICE RANGE

- Two-Wheelers:
  - Available Range: **\$800 - \$2,000**
  - Maximum Sales Range: **\$800 - \$1,500**
- Four-Wheelers:
  - Available Range: **\$20,000 - \$100,000 and upwards**
  - Maximum Sales Range: **\$30,000 - \$50,000**

#### SALES DATA

- Global Sales:
  - 2023: ~**10.5 million units**
  - Expected 2024: ~**12.5 million units**
- Market Share:
  - 2023: **18%**
  - Expected 2024: **Over 20%**

## HEVs

### PRICE RANGE

- Four-Wheelers:
  - Available Range: **\$20,000 - \$50,000**
  - Maximum Sales Range: **\$25,000 - \$35,000**

### SALES DATA

- Global Sales:
  - 2023: **~3.5 million units**
  - Expected 2024: **~4 million units**
- Market Share:
  - 2023: **7%**
  - Expected 2024: **8%**



## INSIGHTS

**BEVs:** Rapid growth expected

**HEVs:** Maintaining a stable market share and expected to rise further.

**GFAAs:** Has very small segment and expected to rise in future.

## GFAAs(CNG)

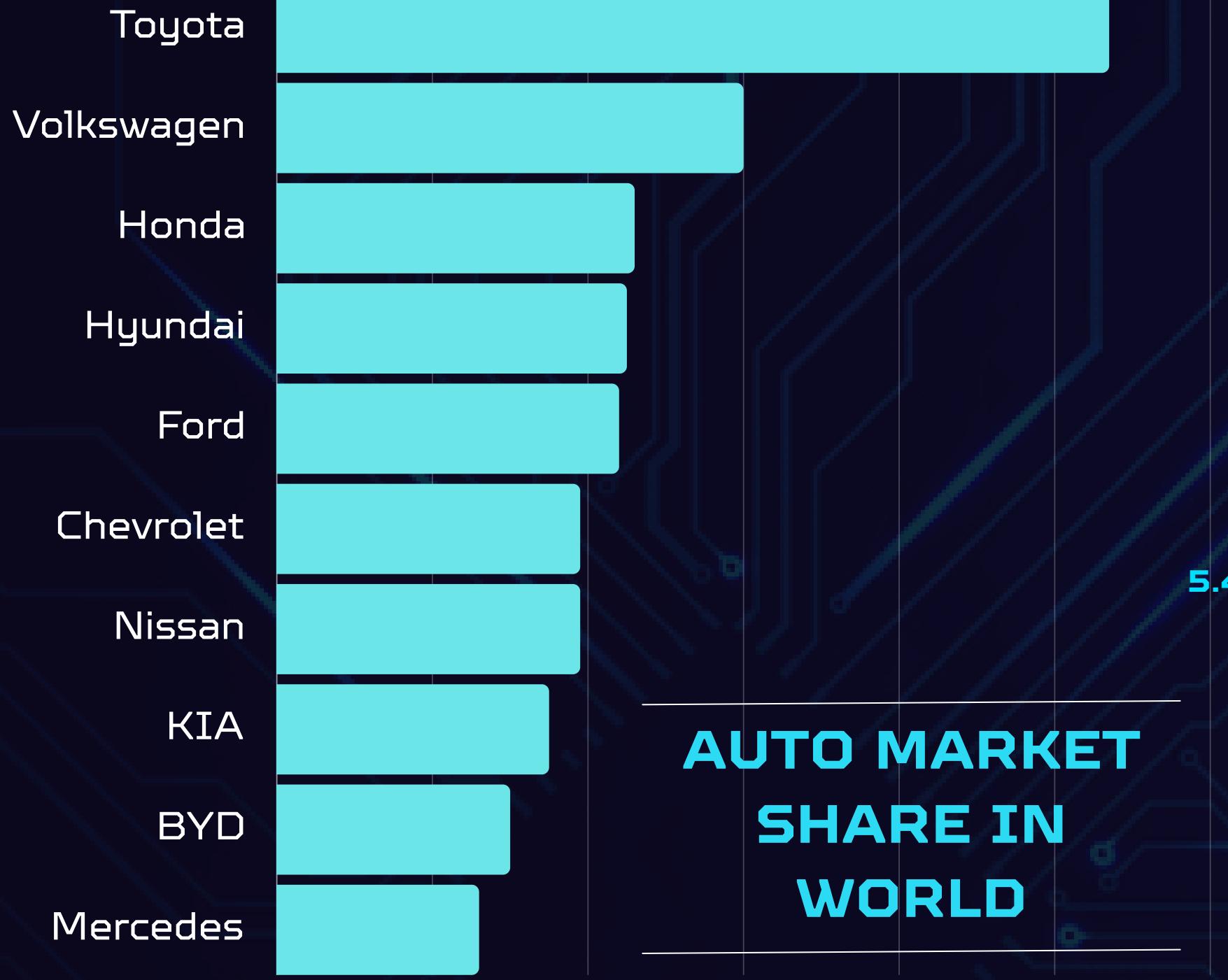
### PRICE RANGE

- Four-Wheelers:
  - Available Range: **\$15,000 - \$40,000**
  - Maximum Sales Range: **\$20,000 - \$30,000**

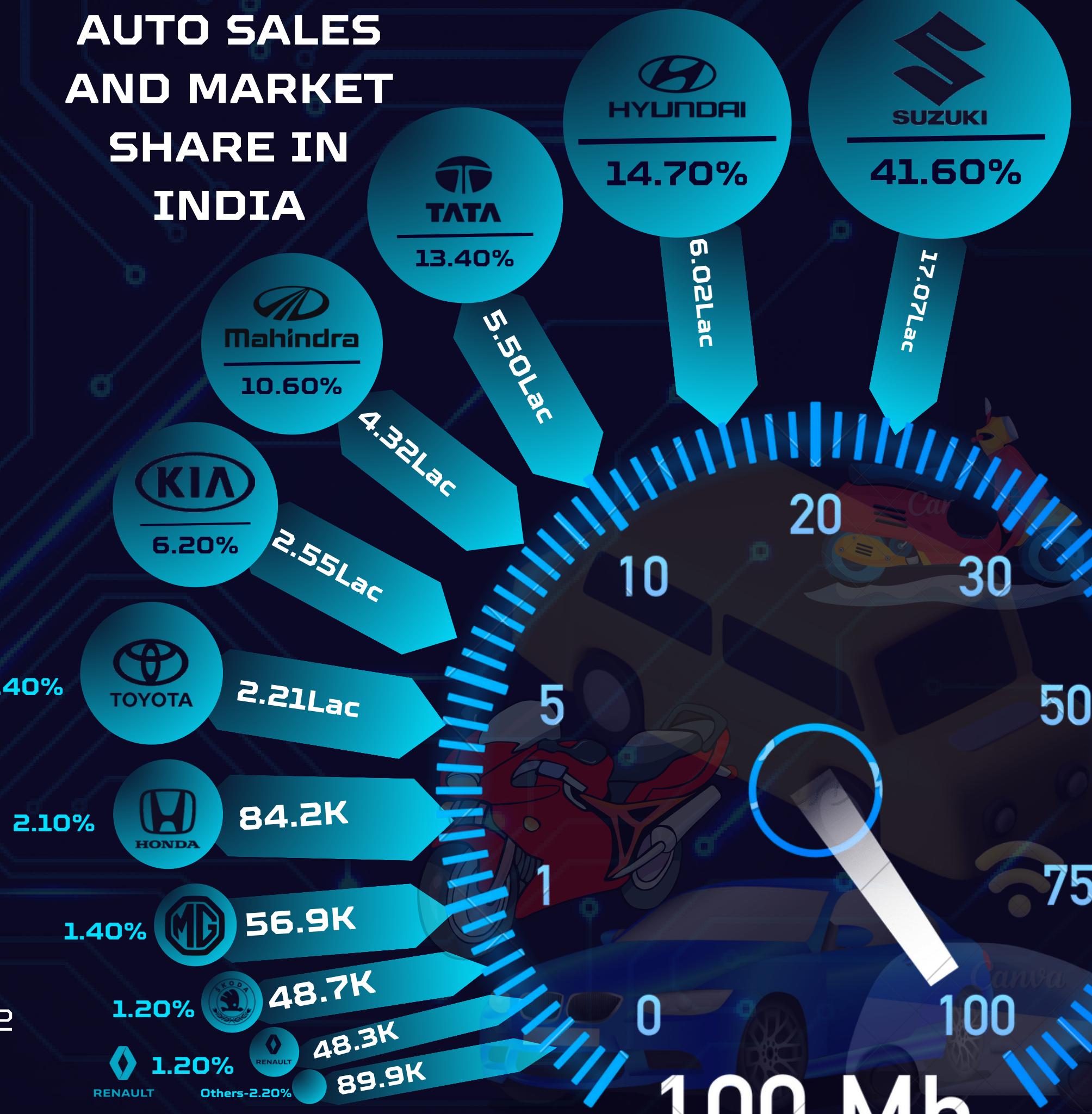
### SALES DATA

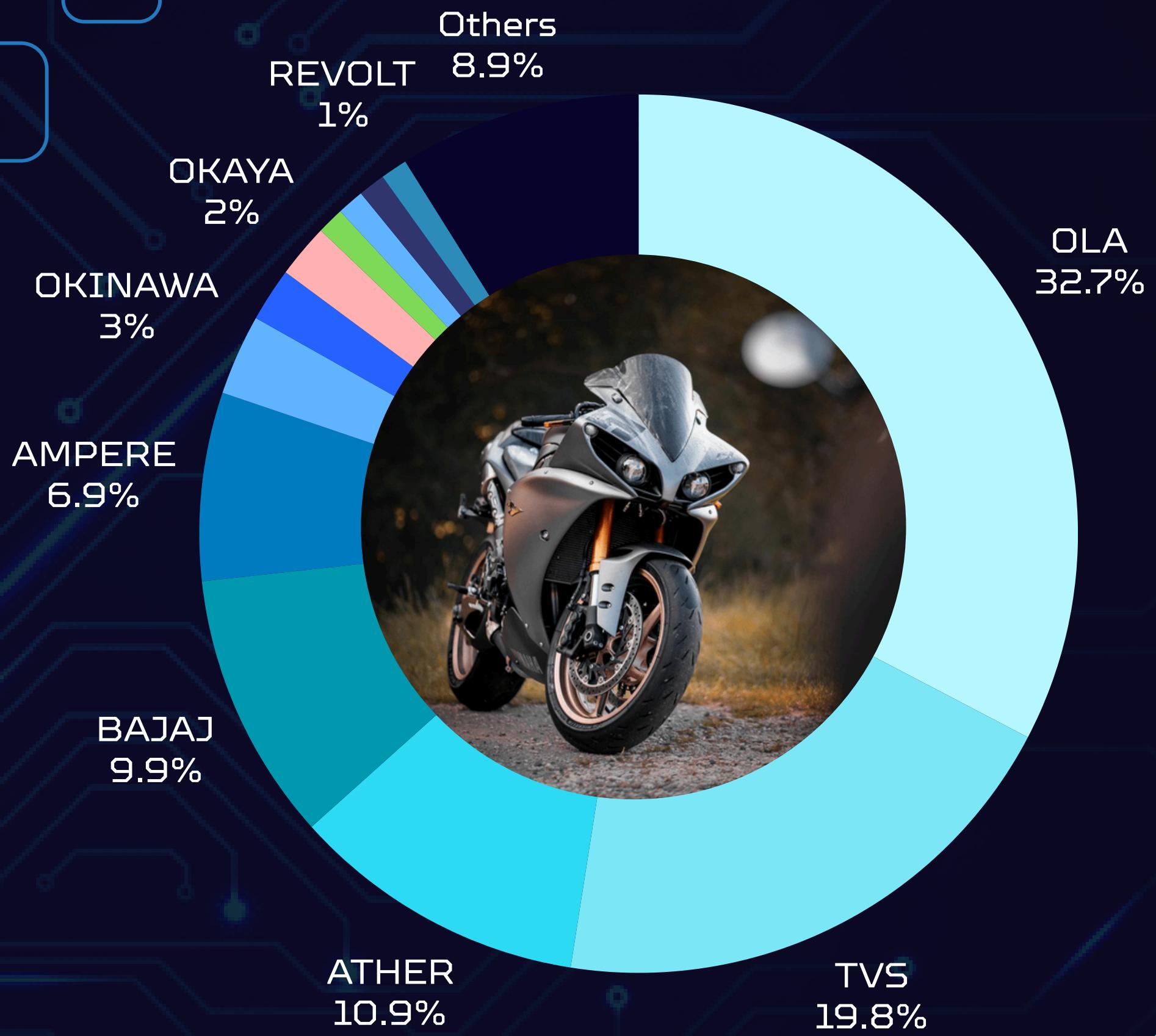
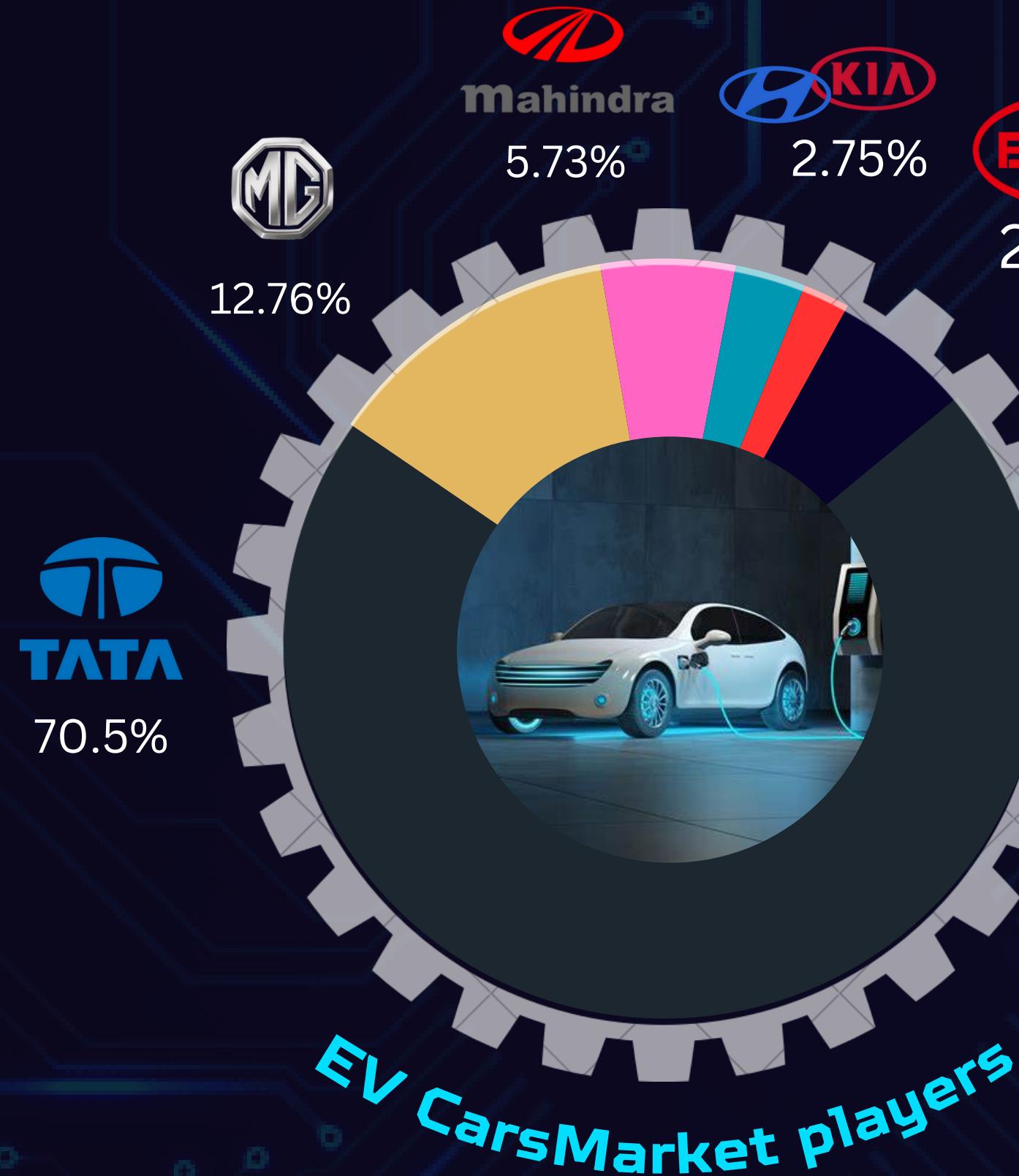
- Global Sales:
  - 2023: **~2 million units**
  - Expected 2024: **~2.5 million units**
- Market Share:
  - 2023: **5%**
  - Expected 2024: **6%**

# KEY PLAYERS



## AUTO SALES AND MARKET SHARE IN INDIA





# KEY STRATEGIES



## Autonomous Driving

**R&D Investments:** Companies like Waymo, Tesla, and Uber are working on self-driving technology.

**Partnerships:** Collaborations with tech companies and startups for autonomous driving systems.



## Global Expansion

**Entering Emerging Markets:** Expanding presence in countries with growing automotive demands, like China and India.

**Local Partnerships:** Forming alliances with local companies to understand and cater to regional markets.



## Sustainability

**Green Manufacturing:** Implementing eco-friendly manufacturing processes.

**Recycling Initiatives:** Developing systems for recycling old batteries and parts.



## Connected Vehicles

**IoT Integration:** Incorporating Internet of Things (IoT) for better connectivity.

**Software Development:** Enhancing in-car entertainment, navigation, and safety features through advanced software.



## Customer Experience

**Personalization:** Offering customized vehicle options.

**Digital Sales Channels:** Enhancing online sales platforms and virtual showrooms.



## Cost Management

**Lean Manufacturing:** Implementing lean manufacturing principles to reduce waste and increase efficiency.

**Supply Chain Optimization:** Streamlining supply chains to reduce costs and improve delivery times.

# >>> PREDICTING THE FUTURE

## Electrification

**Trend:** Explosive growth in BEVs and PHEVs.

**Future:** Charging stations will be as common as gas stations.

## Autonomous Vehicles

**Trend:** Autonomous taxis and delivery drones.

**Future:** Self-driving cars navigating bustling city streets.

## Connectivity and IoT

**Trend:** Smart vehicles communicating with everything.

**Future:** Vehicles talking to traffic lights, reducing congestion.

## Sustainability

**Trend:** Green manufacturing and recycling.

**Future:** Cars made from recycled materials and powered by renewable energy.

## Shared Mobility

**Trend:** Rise of car-sharing and subscription models.

**Future:** Seamless integration with public transport for a hassle-free commute.

# INVESTMENT ROADMAP

The researches shows that there is a **DECLINING** trend in the **conventional vehicles sales** and a **BOOST** in the sales of **cleaner fuel alternatives** of which, **EVs'** sales has shown a tremendous hike.

*\*{0-4 : Strategic Investment  
5-7 : Enhancing growth}*



## Market Trends

Conduct detailed market analysis and identify trends like EVs, autonomous driving, sustainability

01

## Diversification

Invest in Traditional Automakers and Startups

02

## Innovative Future

Focus on EVs, battery tech, and AI-driven systems

03

## Infrastructure

EV charging and grid, Essential for supporting EV adoption

04



## Partnerships

Collaborations with tech firms and energy providers to drive innovation

05

## Sustainability

Companies committed to reducing carbon footprints and developing green technologies

06

## R&D

Importance of continuous investment in R&D for technological advancements and market leadership

07



# PESTEL

## ANALYSIS OF THE AUTOMOBILE SECTOR

P

- Government policies on emissions
- Trade tariffs
- Subsidies for electric vehicles



High

E

- Market growth
- Fuel prices
- Consumer purchasing power



High

S

- Shifts towards sustainability
- Urbanization
- Changing consumer preferences



Medium

T

- Advances in electric vehicles
- Autonomous driving
- Connectivity



High

E

- Emission standards
- Carbon footprint
- Recycling



Increasingly High

L

- Safety regulations
- Compliance requirements
- Labor laws



Medium

**SWOT**



# SWOT ANALYSIS

Analyzing the

- Strengths
- Weaknesses
- Opportunities
- Threats

for all the three types, i.e. Battery Electric Vehicles, Hybrid Electric Vehicles and Green Fuel Vehicles.

# BATTERY ELECTRIC VEHICLES



## STRENGTHS

- Zero emissions
- Lower operating costs
- Advancing technology

## WEAKNESSES

- High initial cost
- Limited charging infrastructure
- Range anxiety

## OPPORTUNITIES

- Improved battery tech
- Policy support
- Growing market demand

## THREATS

- Resource dependence
- Intense competition
- Economic fluctuations

# HYBRID ELECTRIC VEHICLES



## STRENGTHS

- Better fuel efficiency
- Lower emissions
- Extended range

## WEAKNESSES

- Complex engineering
- Higher purchase price
- Partial solution

## OPPORTUNITIES

- Integrating new tech
- Capturing niche markets
- Policy incentives

## THREATS

- BEV advancements
- Policy shifts
- Economic factors

# GREEN FUEL VEHICLES



## STRENGTHS

- Lower emissions
- Existing fuel infrastructure
- Renewable hydrogen potential

## WEAKNESSES

- Limited refueling stations
- Higher costs
- Lower efficiency

## OPPORTUNITIES

- Government incentives
- Technological advances
- Industry partnerships

## THREATS

- Competing technologies (BEVs)
- Economic viability
- Regulatory changes

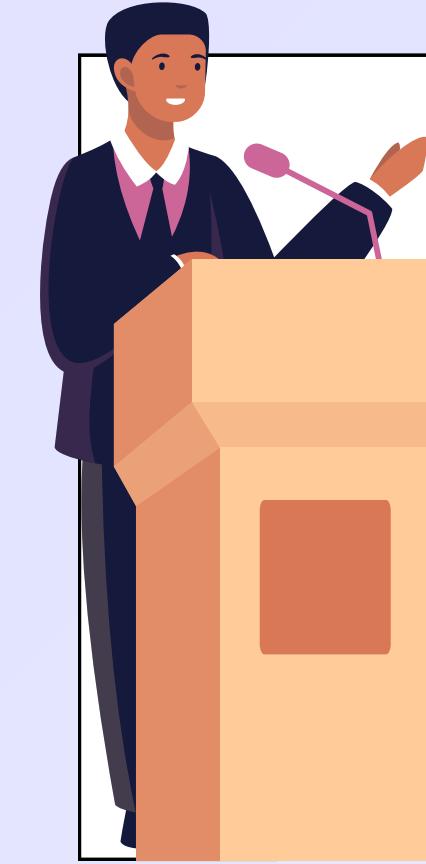


# WEAVING SCENARIOS

Analysis of different possible scenarios and their possible impact on all the three types, i.e. **Battery Electric Vehicles**, **Hybrid Electric Vehicles** and **Green Fuel Vehicles**.

# ASSUMPTION

- Stringent emissions regulations worldwide.
- Substantial government subsidies and incentives for BEVs.



1

POLICY-DRIVEN  
BEV ADOPTION

# IMPACT

- **BEVs:** Rapid adoption across all vehicle segments.
- **Green Fuel Vehicles:** Limited growth due to regulatory focus on zero-emission vehicles.
- **Hybrid Vehicles:** Decline as consumers shift to fully electric options.

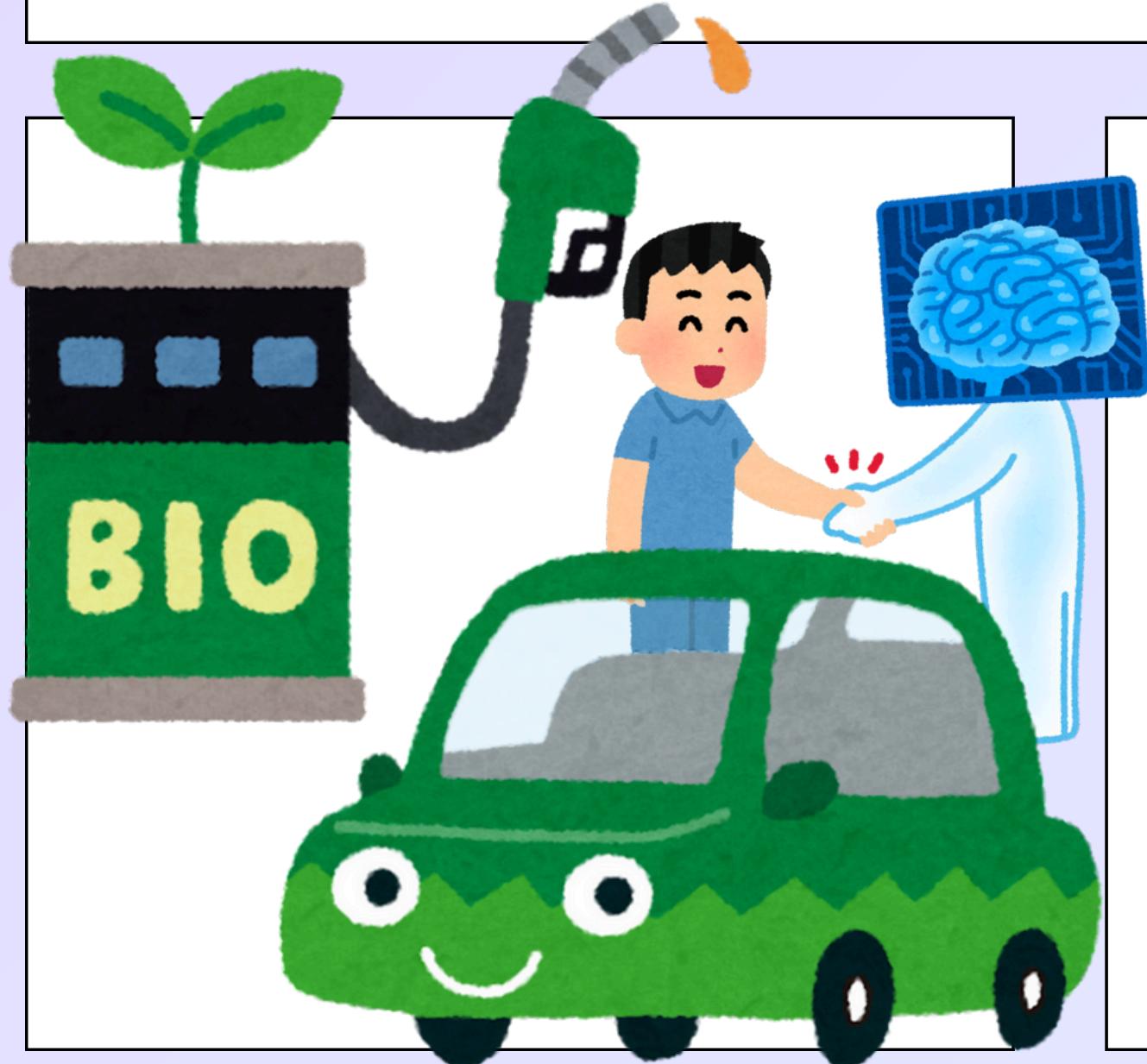


# ASSUMPTION

- Breakthroughs in hydrogen fuel cell and CNG technology.
- Cost reductions and improved infrastructure.



TECHNOLOGICAL  
ADVANCEMENTS IN  
GREEN FUEL VEHICLES

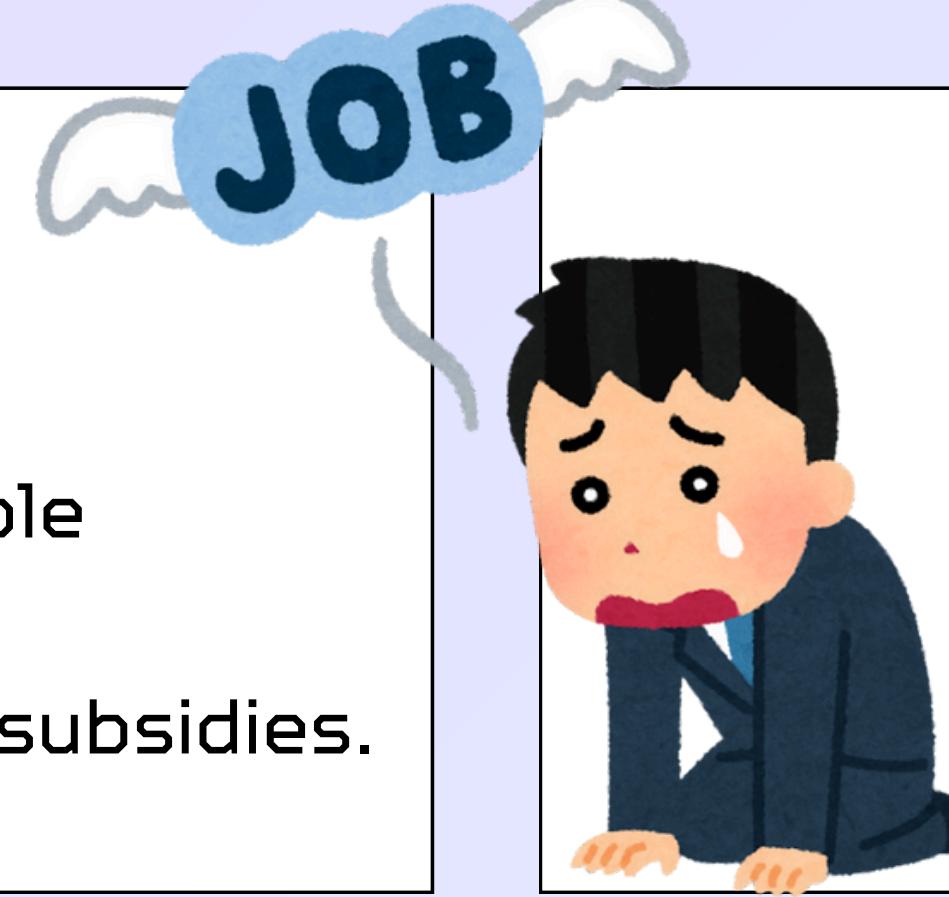


# IMPACT

- **BEVs:** Moderate growth, primarily in urban areas.
- **Green Fuel Vehicles:** Significant adoption, especially in heavy transport and regions with existing infrastructure.
- **Hybrid Vehicles:** Stable market share, benefiting from diversified fuel options.

# ASSUMPTION

- Global economic downturn affecting disposable income.
- Governments scaling back on environmental subsidies.



3!

ECONOMIC RECESSION

# IMPACT

- **BEVs:** Slowed adoption due to higher upfront costs.
- **Green Fuel Vehicles:** Moderate impact, potentially more affordable than BEVs.
- **Hybrid Vehicles:** Increased appeal due to lower cost of ownership and fuel efficiency.



# ASSUMPTION

- Significant new petroleum reserves discovered, potentially reducing global oil prices.
- Exploration and extraction technologies advance, making extraction cost-effective.



# IMPACT

- **BEVs:** Slowdown in adoption rates as traditional fuel vehicles become cheaper to operate.
- **Green Fuel Vehicles:** Reduced market competitiveness due to lower fuel prices and increased availability of traditional fuels.
- **Hybrid Vehicles:** Market share stabilizes as consumers opt for cheaper traditional fuel options.

# >>> INNOVATIVE IDEAS TO PROMOTE EV



## ADVANCED BATTERY TECHNOLOGY

Invest in R&D to develop next-generation battery technology with higher energy density, faster charging capabilities, and longer lifespan.



## MODULAR VEHICLE PLATFORMS

Develop modular vehicle platforms that allow for flexible customization and scalability across different vehicle types and market segments



## INTEGRATED ENERGY ECOSYSTEM

Create an integrated energy ecosystem that combines EVs with renewable energy sources, energy storage solutions, and smart grid technologies



## VEHICLE-TO-GRID (V2G) TECHNOLOGY

Technology that enables bidirectional energy flow between EVs and the power grid. This allows EVs to serve as mobile energy storage units, providing grid stabilization, peak load management, and emergency backup power



## URBAN MOBILITY SOLUTIONS

Develop innovative urban mobility solutions tailored to the needs of urban commuters, such as electric micro-mobility vehicles, shared mobility platforms, and on-demand ride-hailing services.



## AUTONOMOUS DRIVING

This could include features such as lane-keeping assist, adaptive cruise control, and autonomous parking capabilities, positioning JSW Group as a leader in autonomous mobility technology.



## SUBSCRIPTION-BASED OWNERSHIP MODELS

Offer innovative subscription-based ownership models that provide customers with access to EVs on a flexible, pay-as-you-go basis



## CIRCULAR ECONOMY INITIATIVES

Implement circular economy initiatives to minimize waste and maximize resource efficiency throughout the EV lifecycle



# TEAM



Inquisitive Creature



Muskan

**THANK YOU**

# SOURCES

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