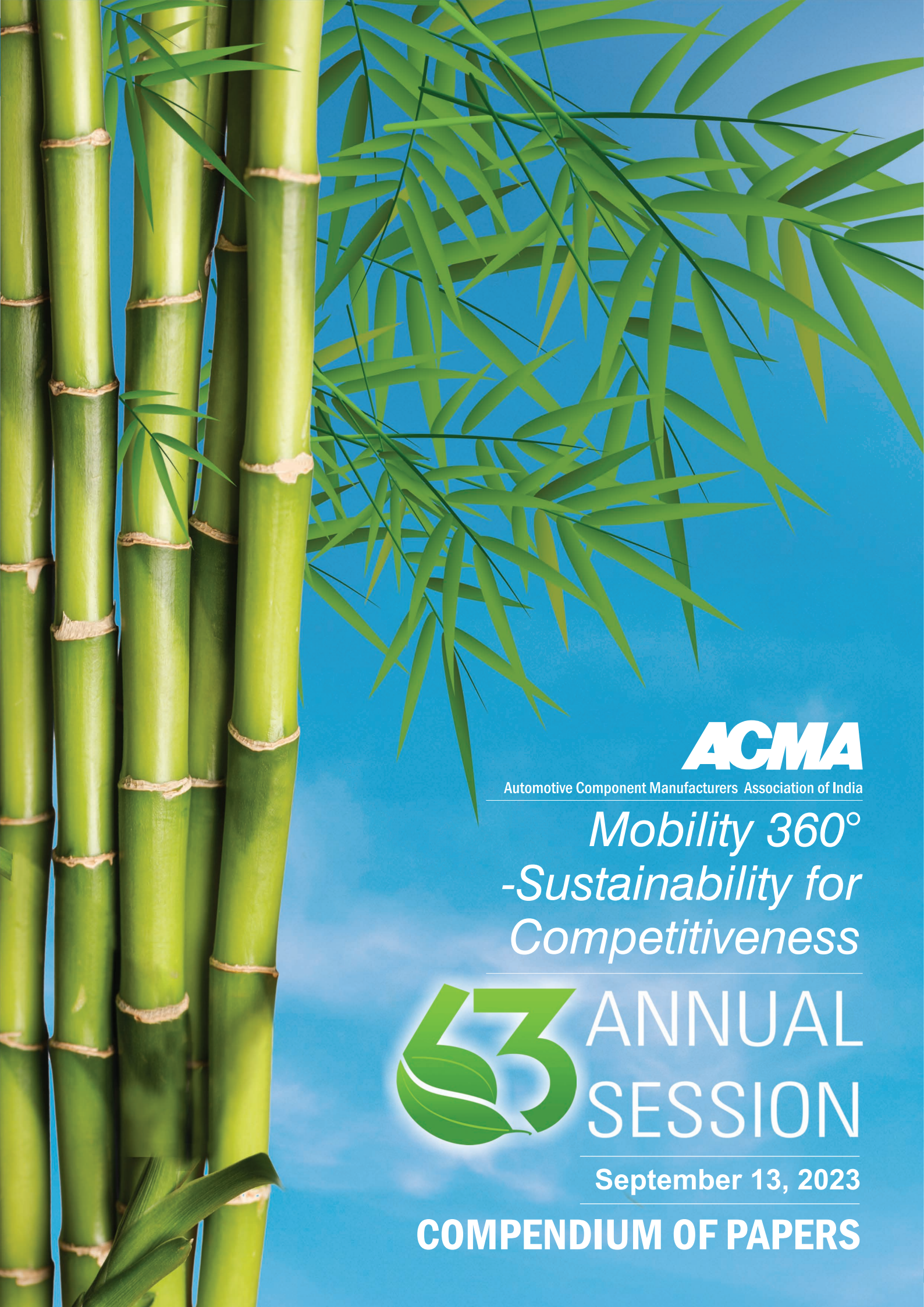


ACMA

Automotive Component Manufacturers Association of India

Mobility 360° -Sustainability for Competitiveness

63 ANNUAL SESSION

September 13, 2023

COMPENDIUM OF PAPERS



ACMA

Automotive Component Manufacturers Association of India

63rd Annual Session

Mobility 360° - Sustainability for Competitiveness

Compendium of Papers

September 13, 2023
Taj Palace, New Delhi

Automotive Component Manufacturers Association of India
6th Floor, The Capital Court, Olof Palme Marg, Munirka, New Delhi - 110 067, India
Phone : 91-11-2616 0315 • Fax: 91-11-2616 0317
e-mail : acma@acma.in • www.acma.in

Papers Contributed

By

CRISIL
An S&P Global Company

RAEninrac

EY
Building a better working world

Grant Thornton

ICRA

Sanathana

Disclaimer : This compendium contains papers contributed by renowned consulting firms. The papers have been complied with the intent of keeping ACMA members abreast of automotive trends in India and overseas. The views expressed in the papers are solely those of the consultants. It is not intended to be substitute for detailed research or exercise of professional judgement.

Your feedback is valuable to us. We would appreciate your compliments and suggestions in order to improve the publication.
Please write to Ms. Shikha Tripathi, Deputy Director (Government Affairs & Public Policy) at shikha.tripathi@acma.in and / or Mr. Binny Tomy, Assistant Director (Director General's Office) at binny.tomy@acma.in

About ACMA

The Automotive Component Manufacturers Association of India (ACMA) is a apex body representing India's Component Industry. It boasts a membership exceeding 850 manufacturers, contributing to more than 85% of the auto component industry's total turnover. ACMA proudly holds ISO 9001:2015 certification.

ACMAs primary mission revolves around stimulating growth, job creation, and economic prosperity. Through its relentless dedication to research & development initiatives, ACMA ensures that India maintains a leading position in global automotive component manufacturing.

With its continually expanding network, ACMA empowers businesses by providing invaluable resources, industry insights, and opportunities for collaborative endeavours. The organization plays an indispensable role in shaping policies and regulations that nurture an environment conducive to sustainable growth.

India's automotive industry is a vital sector, contributing 49% to the country's manufacturing GDP, 6.5% to the overall GDP, and supporting approximately 30 million jobs. Despite challenges like chip shortages, overbooking, fuel price-induced inflation, and rising commodity prices, the overall industry is valued at $150 billion.

In the fiscal year 2022-23, on the back of strong vehicle sales, a robust aftermarket, and growing exports, the auto component industry achieved unprecedented success. It reached a size of Rs. 5.60 lakh crore (USD 69.7 billion), recording a remarkable growth of 32.8%, surpassing the previous high turnover of Rs. 4.20 lakh crore in FY21-22. Exports increased by 5.2% to Rs. 1.61 lakh crore (USD 20.1 billion), while imports grew by 10.9% to Rs. 1.63 lakh crore (USD 20.3 billion). The Aftermarket, estimated at Rs. 85,333 crores, also saw steady growth, registering a 15% increase. Auto component sales to OEMs in the domestic market surged by 39.5% to Rs. 4.76 lakh crore.

This growth in domestic auto component sales to OEMs, reaching Rs. 4.76 lakh crores (USD 59.3 billion), reflects a 39.5% increase compared to the previous year. The demand for higher-value components and a shift towards larger, more powerful vehicles contributed to this growth.

In 2022-23, exports of auto components grew by 5.2% to Rs. 1.61 lakh crore (USD 20.1 billion) compared to Rs. 1.41 lakh crore (USD 19.0 billion) in 2021-22. North America accounted for 32% of exports, with an 8% growth, while Europe (31%) and Asia (26%) saw 3% and 4% growth, respectively. Key export items included drive transmission and steering, engine components, body/chassis, suspension, and braking systems.

Domestic market traction also led to an increase in component imports into India, growing by 10.9% in 2022-23 to Rs. 1.63 lakh crore (USD 20.3 billion) from Rs. 1.36 lakh crore (USD 18.3 billion) in 2021-22. Asia represented 66% of imports, followed by Europe (26%) and North America (6%), with growth rates of 12%, 6%, and 23%, respectively.

Post-pandemic, increased vehicle movement and demand for used vehicles boosted the aftermarket across all segments. The aftermarket turnover in FY 2022-23 reached Rs. 85,333 crore (USD 10.6 billion), compared to Rs. 74,203 crore (USD 10.0 billion) in the previous year.

ACMA plays a crucial role in the industry's development in India, actively engaging in trade promotion, technology enhancement, quality improvement, and information dissemination. It participates in international trade fairs, sends trade delegations overseas, and publishes materials on various automotive industry-related subjects.

ACMA also contributes to manufacturing advancements by offering skills training and mentoring through cluster programs and special projects such as 'Asset Turnover Improvement,' 'Uptime Improvement,' 'Zero Defect Quality,' and 'Sustainable Manufacturing,' among others. Additionally, ACMA is well-represented on various government panels, committees, and councils, helping shape policies and regulations for the Indian automotive industry.

For information exchange and cooperation in trade matters, ACMA has signed Memoranda of Understanding (MoUs) with counterparts in multiple countries, including Argentina, Australia, Brazil, Canada, Egypt, France, Germany, Hungary, Iran, Italy, Japan, Kazakhstan, Malaysia, Mexico, Nigeria, Pakistan, Poland, Russia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Taiwan, Thailand, Tunisia, Turkey, the UK, the USA, and Uzbekistan.

You can find more information and data about the Indian automotive industry on the ACMA website: www.acma.in

ACMA
Automotive Component Manufacturers Association of India

HEAD OFFICE
6th Floor, The Capital Court, Olof Palme Marg,
Munirka, New Delhi 110 067, India
Tel: +91 11 2616 0315 | Fax: +91 11 2616 0317
Email: acma@acma.in

REGIONAL OFFICES

Eastern Region
Room No. 4
Centre for Excellence
Jubilee Road
Jamshedpur 831001
Tel: +91-44-28330968,
28330949
Telefax: +91-44-28330590
E-mail: acmaer@acma.in

Northern Region
6th Floor,
The Capital Court,
Olof Palme Marg,
Munirka
New Delhi 110 067
Tel: +91-11-26160315
Fax: +91-11-26160317
E-mail: acmanr@acma.in

Southern Region
1-B, "Crystal Lawn"
20 Haddows Road,
1st Street
Chennai 600 006
Tel: +91-44-28330968,
28330949
Fax: +91-44-28330590
E-mail: acmasr@acma.in

Western Region
Office No. C, 10th Floor,
Godrej Eternia "C",
B-wing, Old Mumbai-Pune
Highway, Wakdewadi, Shivaji Nagar
Pune – 411 005
Maharashtra, India
Tel: +91-20-6606 1219/20
Fax: +91-20 6606 1220
E-mail: acmawr@acma.in

ZONAL OFFICES

Southern Region (Karnataka & Hosur)
Shop No. 1, 1st Floor,
NGV Commercial Complex,
National Games Village,
Koramangala, Bangalore 560 047,
Karnataka
Tel: +91 80-2570 2855
Fax: +91-80-40939689
E-mail: acmakh@acma.in

Western Region (Mumbai)
80, Dr. Annie Besant Road,
Worli, Mumbai - 400 018,
Maharashtra, India
Tel: +91-20-6606 1219/20
Fax: +91-20 6606 1220
E-mail: acmawr@acma.in

Western Region (Gujarat)
801 "Matrix", Near Vodafone House,
B/H Divya Bhaskar, Corporate Road,
Ahmedabad – 380015,
Gujarat
Tel: +91-20-6606 1219/20
Fax: +91-20 6606 1220
E-mail: acmawr@acma.in

Find Us At:
Facebook.com/India.acma
ACMA India
@ACMAindia

www.acma.in

63rd Annual Session

Mobility 360° - Sustainability For Competitiveness

Contents

TOPIC	Page No.
MOBILITY 360° Sustainability for Competitiveness	06
An Update on Indian Auto Component Industry FY 2022-23 by ACMA	09
Driving Steady: Outlook on the Indian Economy and its Automobile Industry by CRISIL	16
Hydrogen Roadmap & Flexibility-Transforming Indian Automotive Industry in Sustainable Era by ENINRAC	49
Accelerating Sustainability: Incentives Driving Change in the Automobile Sector by EY	87
Reducing the carbon footprint in the automotive industry by GRANT THORNTON BHARAT	105
Ethanol blended petrol as a path to decarbonization by ICRA	135
What Drives Auto Demand: Macro-Consumer-Industry Based Study-Automobile and Components Forecasting by SANATHANA	154
Advertisement of Sponsors	166

Mobility 360° - Sustainability For Competitiveness

The Auto Component Industry in India:
Mobility 360° - Sustainability for Competitiveness

An Introductory Note

India is aspiring to achieve net zero by 2070. A pillar of India's economy, the automotive and auto-ancillaries industry contributes 2.1 percent of national GDP, and basis its manufacturing volumes, is also responsible for around 1.4 percent of India's overall greenhouse-gas emissions. Raising the bar on sustainability as an industry could help the sector not just make a difference to India's net-zero journey, but also help companies generate growth and value.

The growing importance of sustainability.

As climate change concerns intensify around the world, customers, regulators, and investors are demanding more sustainable practices from the automotive and auto-ancillary industry. Regulatory policies are growing (from around 100 policies in the early 2000s to around 900 today) to hasten the pace towards net zero. For example, SEBI's Business Responsibility and Sustainability Reporting (BRSR) format requires all listed companies in India to disclose various ESG metrics. As governments around the globe introduce new sustainability policies, Indian automotive suppliers may strive to be future-ready from a compliance standpoint to be able to serve these markets. Investment money is moving fast towards sustainability, with sustainability-led funds growing in India at a CAGR of 120 percent between 2019 and 2021, and investments exceeding INR 10,000 crore locked in just in the first half of 2023.

With this growing thrust on sustainability all around the world, companies worldwide and in India are also prioritizing the topic. Over 180 Indian companies have adopted decarbonization targets verified by the Science Based Targets initiative. Their efforts focus heavily on controlling their Scope 1 and 2 emissions, while encouraging their suppliers to bring down Scope 3 upstream emissions.

An imperative and an opportunity

Sustainability is not an imperative alone, it could also make good business sense. As automotive and auto-ancillary companies consider the path forward, they could limit themselves to “playing defense” (minimum compliance) or could choose to “play offense” – going beyond compliance to actively create value for their business, especially by tapping new business opportunities (e.g., remanufacturing, refurbishment, and repair, etc.), cultivating sustainability qualification-led growth (e.g., compliant companies could have a higher number of RfQ successes), and attaining sustainability-led cost reduction (e.g., decarbonization and recycling are likely to help reduce costs). These initiatives could help them raise their valuation by 20 to 30 percent across EBITDA and multiples.

The path towards decarbonization

The path to sustainability has two important themes for automotive suppliers – energy decarbonization and material circularity.

Energy decarbonization: Companies could pursue the energy transition through seeking scalable, cost-efficient alternatives to their highest-emission energy sources. Even by 2030, grid power could be predominantly coal-based (at around 57 percent), making it important for suppliers to find an accelerated path to decarbonization.

1.Science Based Targets initiative, companies' ESG/Sustainability reports on Scope 1-3, 2022
2.Science Based Targets initiative
3.Decarbonising India: Charting a pathway for sustainable growth, McKinsey & Company, 27 October 2022

The different alternatives available vary in technical feasibility, and companies could use the solution sets outlined in Chapter 3 of this report to identify the options that work best for them – beginning with implementing rooftop solar and installing VFDs, and group captives, which have effectively reduced GHG emissions and operating costs for various companies in India.

Material circularity: This could increase top line by 10 to 20 percent, reduce costs by 5 to 10 percent, cut down virgin-material use by 20 to 40 percent, and decrease carbon emissions by 50 to 70 percent. The four loops – recycle, refurbish, resell/rent and repair – extend the period materials remain within the system, cutting emissions and costs. The market opportunity for automotive component circularity by FY30 could be USD 3.8 to 5 billion, across three themes – material recirculation, circular product design and repair, care, and refurbishment services.

Promoting material circularity in India could call for overcoming the many barriers that complicate circularity – insufficiently organized recyclers, higher costs, low recovery rates (for e-waste and reusable parts), and demand for recycled products as well as hard-to-recycle components. This could change over time, with supportive policy and regulatory support (e.g., Vehicle Scrappage Policy, 2022), improved recycling economics, and advancements in recycling technologies. More and more companies working towards circularity could inspire cooperation and competition. And finally, material circularity through recycled materials could also boost local availability, reducing supply-chain risk.

Stakeholders as enablers

Mitigating the impact of industrial processes to protect the environment and operate with a high sustainability quotient in India is likely to be a team effort among all stakeholders.

OEMs could support suppliers in their sustainability journey by setting up timely decarbonization targets and helping them to create a roadmap towards net zero. OEMs could also provide targeted support such as access to renewable energy, support on material circularity, etc. The government could explore further strengthening reporting regulations and implementing more policies or subsidies to promote a circular economy. Automotive industry bodies could tailor scalable sustainability frameworks, foster capability building and collaboration for innovation, and recognize suppliers who lead the way on sustainability metrics. And private entities such as financial institutions, energy providers and private-equity firms could create a conducive environment for these transitions.

Auto component manufacturers or suppliers could be at the forefront of this transformation by prioritizing sustainability, investing in energy transition initiatives, and working closely with OEMs to drive circularity and invest in green business. The right strategic approach, supported by frameworks to address the most feasible drivers for change, could help make a difference – embedding sustainability in industrial practices and unlocking significant value.

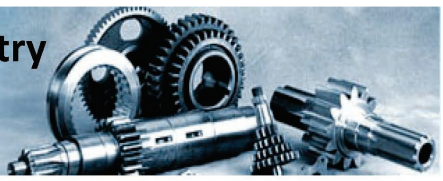
An Update on Indian Auto Component Industry FY 2022-23

by

ACMA

ACMA
Automotive Component Manufacturers Association of India

An Update on Indian Auto Component Industry

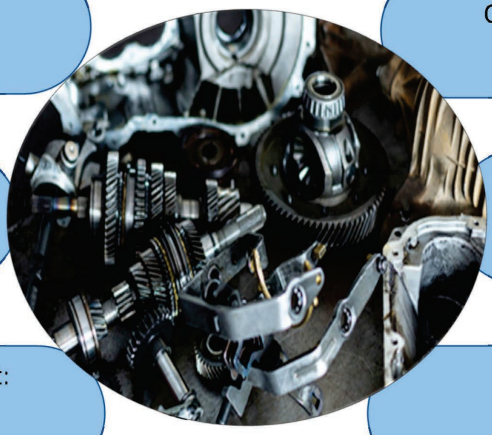


FY 2023

FY 23-Snapshot of Indian Auto Component Industry

Turnover:
USD 69.7 Billion
INR 559,748 Crore

Contribution to GDP :
2.7%



Exports :
USD 20.1 Billion
INR 161,483 Crore

Share in India's Exports:
4.5%

Domestic Aftermarket:
USD 10.6 Billion
INR 85,333 Crore

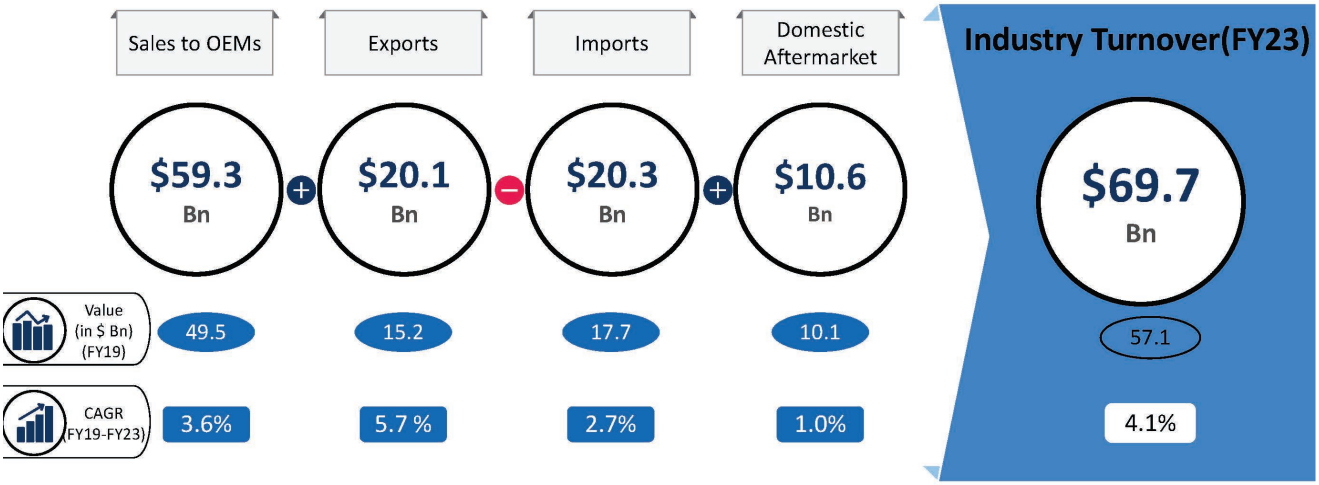
Employment :
50 Lakh (Approx)

ACMA

2

FY 19-23: Overview of the Indian auto component industry

Auto Component Industry growth over last 5yrs driven by robust domestic vehicles sales, strong aftermarket and increasing exports.

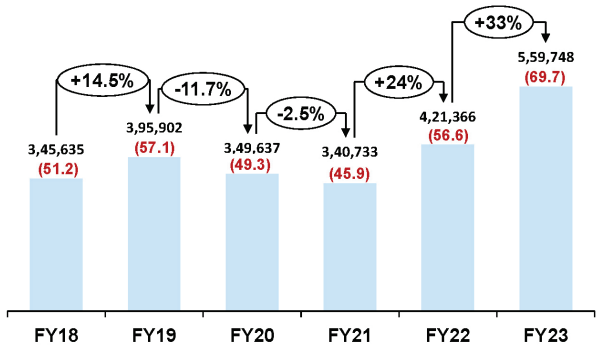


ACMA

FY 23: Auto Components Industry Performance

Size of industry | INR Cr (USD Bn)

Growth % taken against INR Values



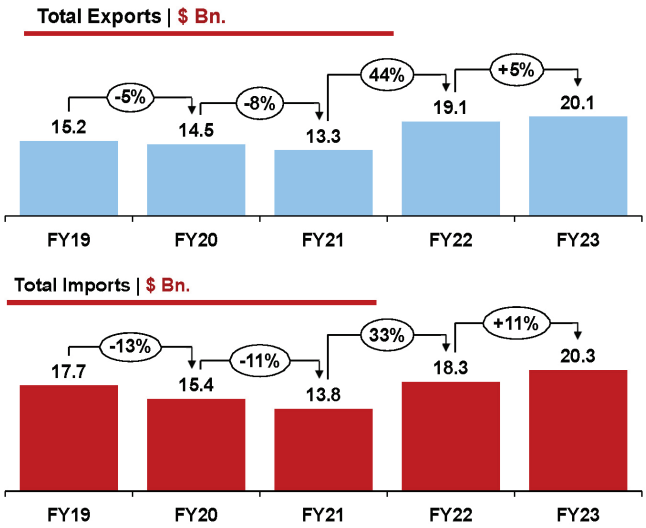
FY23 – Auto components industry performance

- Auto component industry[1] grew appreciably in FY23 on the back of pent-up vehicles demand driving sales, easing of supply shortages, and sales mix favoring larger vehicles
- Electric vehicles[2] accounted for ~2.9% of vehicles produced & ~2.7% total component consumption
- **Shift in preferences:** Customers have started to move towards **larger/more powerful vehicles** across all segments;
  - UVs (amongst PVs) – 49% in FY23 (vs. 46% in FY22),
  - M&HCVs (amongst CVs) – 37% in FY23 (vs. 34% in FY22)
  - Motorcycle Engine Capacity >250 CC<350 CC (amongst 2Whs) -3.23% in FY23 (vs. 4.17% in FY22)

Notes: 1 - excludes tyres, paints, powder coating, batteries & consumables
2 - EVs include only Li ion battery operated vehicles. Cost of Li ion battery excluded from component consumption calculations

ACMA

FY 23: Exports & Imports - Balance of Trade



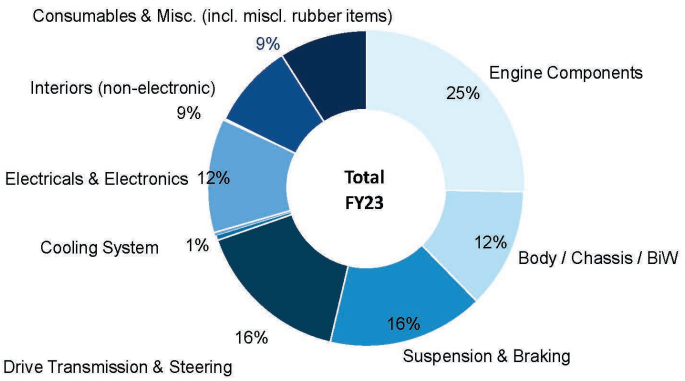
FY23- EXIM Performance

- Exports grew by **~5%** and imports by **11%** (vs. FY22)
- The trade deficit was $200 million
- Several players expanded capacity due to positive exports outlook stemming from schemes such as Product Linked Incentive (PLI) and FTP

ACMA

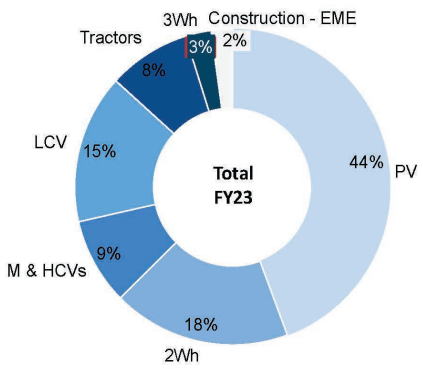
FY 23: Auto Components Industry Performance

Overall Component Sales By Category:



Total Sales: Rs.559,748 Cr. (USD 69.7 Bn)
Growth:33%

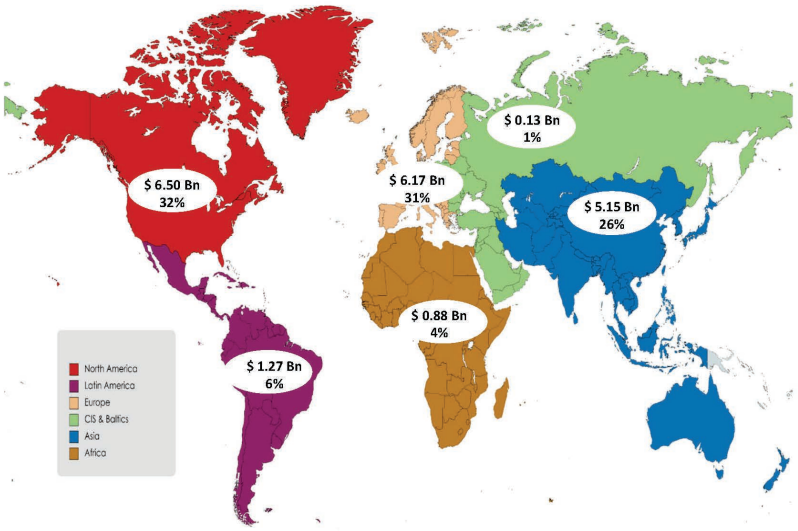
Component Sales to OEMs By Segment:

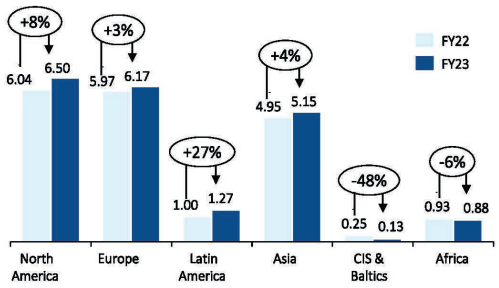


Total Sales to OEMs: Rs.476,022 Cr. (USD 59.3 Bn)
Growth:39.5%

ACMA

FY 23: Region wise Exports

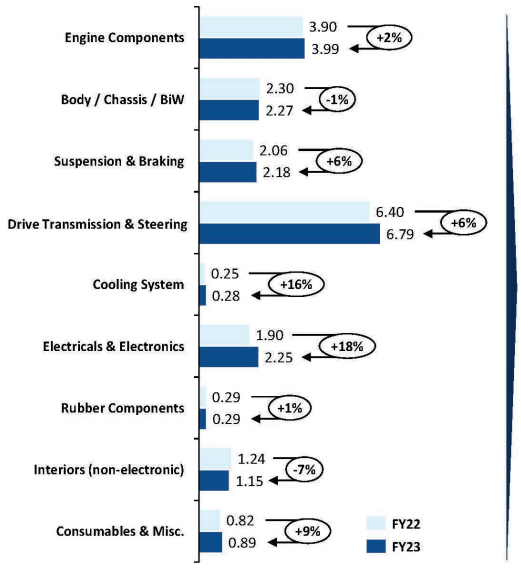


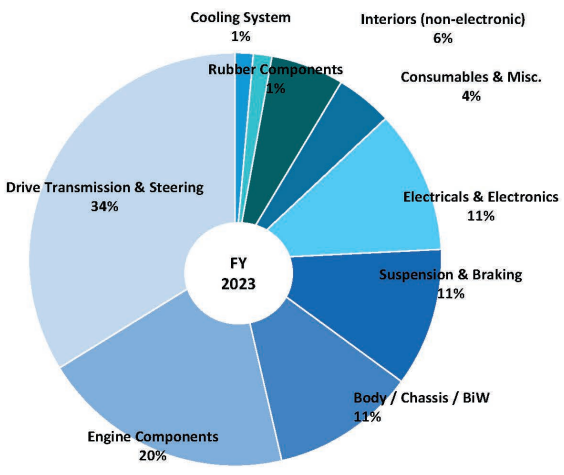


ACMA

7

Exports : Segmentation by product type

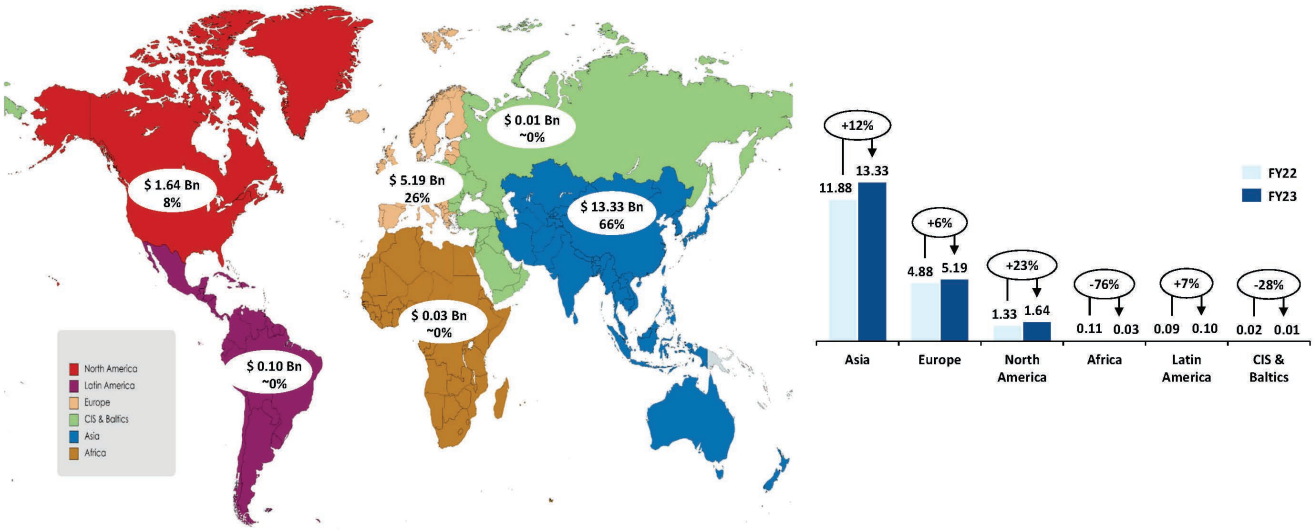




ACMA

8

FY 23: Region wise Imports

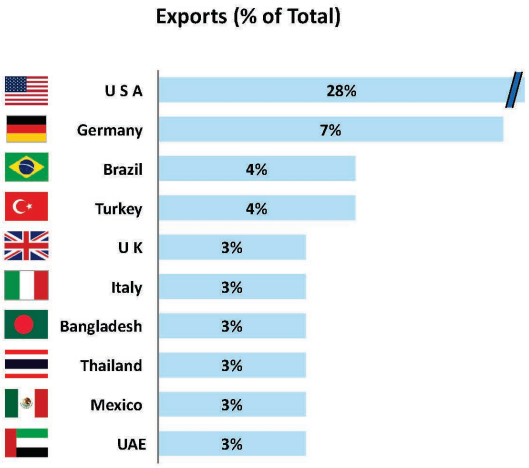


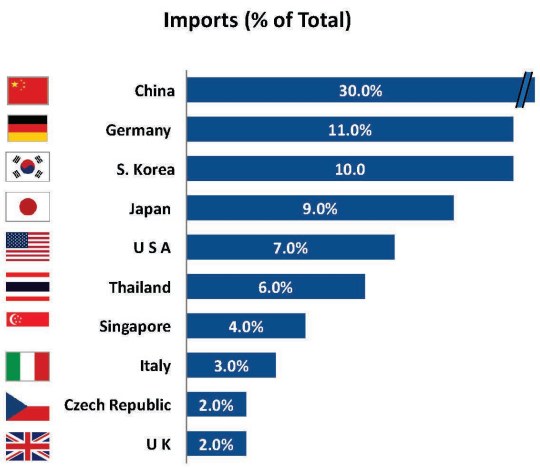
ACMA

9

Country wise: Imports & Exports

USA key destination for exports while China is key source of imports





ACMA

9/6/2023

10

Summary: FY 2023 vs FY 2022

Figures in INR Crore	FY 2022	FY 2023	Growth Rate
Auto Components Supply to OEMs	341,203	476,022	39.5%
Aftermarket	74,203	85,333	15.0%
Exports	142,295	161,483	13.5%
Imports	136,335	163,090	19.6%
Industry Turnover	**420,366**	**559,748**	**32.8%**

Figures in USD Billion	FY 2022	FY 2023	Growth Rate
Auto Components Supply to OEMs	45.8	59.3	29.4%
Aftermarket	10.0	10.6	6.6%
Exports	19.0	20.1	5.2%
Imports	18.3	20.3	10.9%
Industry Turnover	**56.5**	**69.7**	**23.2%**

ACMA

11

For more details, please contact :

ACMA
6th Floor, The Capital Court, Olof Palme Marg,
Munirka, New Delhi-110067,India
Tel : +91 11 26160315 | Fax : +91 11 2616 0317
Email : acma@acma.in

12

Driving Steady: Outlook on the Indian Economy and its Automobile Industry

by

CRISIL
An S&P Global Company

Market Intelligence & Analytics

CRISIL
An S&P Global Company

Contents

1 Economy 4
2 Automobile industry 15
3 Passenger vehicles 17
4 Commercial vehicles 20
5 Two-wheelers 23
6 Tractors 27
7 Electric vehicles domestic sales 32

1 Economy

Real GDP growth

The Indian economy clocked a 4.1% compound annual growth rate (CAGR) between fiscals 2018 and 2023 supported by benign crude oil prices, soft interest rates and narrower current-account deficit.

Key reforms and initiatives taken by the government, such as implementation of the Goods and Services Tax (GST), Insolvency and Bankruptcy Code, Make in India and financial inclusion initiatives, and gradual opening up of sectors such as retail, e-commerce, defence, railways, and insurance to foreign direct investment (FDI) helped.

Over the five-year period, India's economic growth was led by services, followed by the industrial sector. In parts, though, growth was impacted by demonetisation, non-banking financial company (NBFC) crisis, slower global economic growth, and Covid-19.

A large part of the lower print between fiscals 2018 and 2023 was because of a 5.8% contraction in fiscal 2021 due to the fallout of Covid-19. The pandemic's impact was more pronounced on contact-sensitive sectors as social-distancing norms affected services such as entertainment, travel, and tourism. Many industries in the manufacturing sector also faced issues of shortage in raw material/components as lockdowns in various parts of the world upended supply chains.

After a steep contraction in the first half of fiscal 2021 due to rising number of Covid-19 cases, GDP growth moved into positive territory as economic activity revived with gradual lifting of lockdowns in the second half.

In fiscal 2022, India's real GDP grew 9.0% from the low base of fiscal 2021.

According to the National Statistical Office estimates released on May 31, 2023, GDP growth rose a sharp 6.1% on-year in the fourth quarter (January-March) of fiscal 2023, as against a decline of 4.5% in the third quarter, driven by investment and net exports, and support given by rising exports and slowing imports. Fixed investments turned in the strongest growth on the demand side, while private consumption growth was more subdued on-quarter. Manufacturing and agriculture growth improved on-quarter on the supply side, even as services growth remained strong, although slowing down a tad relative to the previous quarter.

The growth surpassed the number factored in the National Statistics Office's (NSO) second advance estimates of February 2023. Following this, annual growth for fiscal 2023 was revised up to 7.2% (provisional estimate) from 7.0% in the second advance estimate.

The provisional estimate of 7.2% comes on top of a 9.1% expansion in fiscal 2022, suggesting strong growth momentum, propelled by domestic demand through the year, both from investment and private consumption. The share of investments rose to an 11-year high of 34% of GDP, while that of private consumption rose to an 18-year high of 58.5% in fiscal 2023.

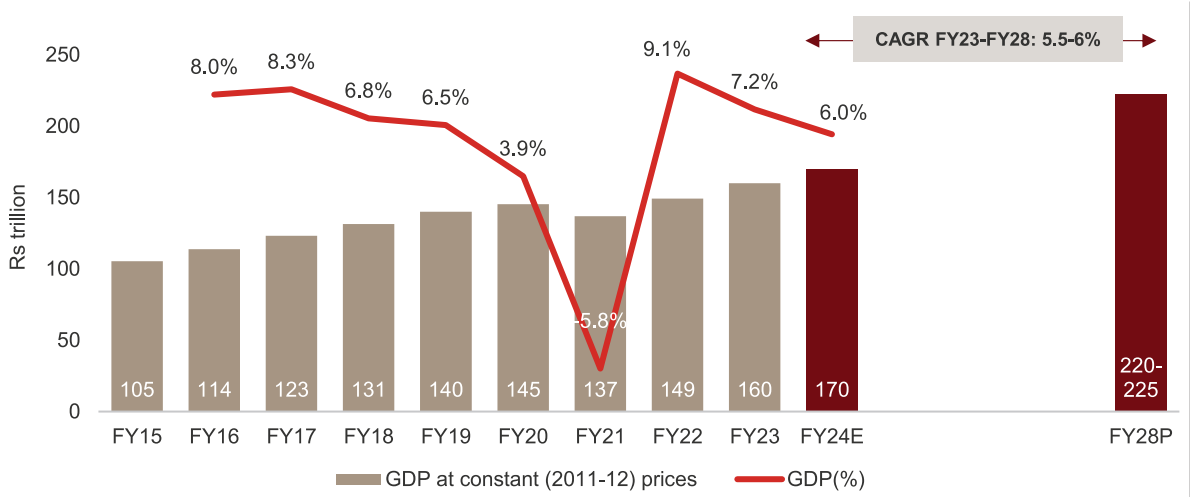
However, nominal GDP growth tapered to 10.4% on-year in the fourth quarter, compared with 11.4% in the third quarter, primarily due to the price effect, as the GDP deflator weakened to 4.1% from 6.6%. The deflator is significantly influenced by the wholesale price index (WPI)-based inflation, which halved to 3.3% from 6.6%. The gap between nominal and real growth is likely to narrow further, with inflation expected to decline this fiscal.

The current fiscal will feel the lagged impact of rate hikes by central banks over the past 15 months. External demand is likely to be a bigger hindrance to growth, with western advanced economies staring at a slowdown in the coming quarters, whipping up a headwind for exports. While domestic demand will also weaken, hit by rising

lending rates, softening inflation and government capex will offer support. Monsoon and El Nino risks remain swing factors.

Owing to these factors, CRISIL MI&A estimates GDP growth to taper to 6.0% in fiscal 2024 from 7.2% in the fiscal 2023, with risks tilted to the downside.

GDP growth review and outlook



Note: E – Estimated, P: Projected
Source: National Statistics Office (NSO), IMF, CRISIL MI&A estimates

On the supply side, gross value added (GVA) grew 6.5% in the fourth quarter of 2023, compared with 4.7% in the previous quarter. Agriculture and allied activities surged to 5.5% from 4.7%, the result of a robust rabi output despite unseasonal rains towards the year-end. Manufacturing growth rose sharply after two quarters of decline (4.5% in the fourth versus -1.4% in the third). Resilient domestic demand, easing commodity prices and supply constraints supported production.

All demand segments witnessed growth in the fourth quarter, with support from private consumption, government consumption, fixed investment, and net exports. Growth in the fourth quarter was driven by a rise in exports and a slowdown in import to 4.9% from 19.7%. Hence, net exports contributed positively to GDP growth.

Among the demand drivers, investment recorded the strongest growth of 8.9% vs 8.0% in the third quarter. The increasing investment growth also indicates a gradual pickup in private capex. Private consumption expenditure improved during the quarter. High inflation may have pressure on household consumption, with inflation based on the Consumer Price Index (CPI) remaining elevated at 6.4% in the quarter.

However, for fiscal 2023, private consumption growth was a strong 7.5% on top of 11.2% attained in fiscal 2022, because of pent-up demand, especially for contact-intensive services.

Exports of goods and services saw a robust 11.9% growth in the quarter versus 11.1% in the previous quarter. Growth in government consumption expenditure slowed sharply to 0.1% from 6.6%, as the pandemic spending subsided.

Within the industry basket, growth improved for construction (10.4% vs 8.3%), reflecting a pickup in capital expenditure, particularly by states. There was a modest improvement in mining (4.3% vs 4.1%), while growth slowed for utilities (6.9% vs 8.2%).

Overall, industrial GVA grew 6.3% versus 2.3% in the third quarter of 2023. Services maintained the momentum, growing 6.9% versus 6.1%. Growth remained strong for trade, hotels, transport, and communication services (THTC), but slowed a tad to 9.1% in the fourth quarter of 2023, from 9.6% in the third quarter. It rose sharply for financial, real estate and professional services (7.1% vs 5.7%) and moved up for public administration and other services (3.1% vs 2.0%).

For fiscal 2023, growth was the strongest for THTC services (14% in fiscal 2023 vs 13.8% previous year), followed by construction (10% vs 14.8%), utilities (9% vs 9.9%), public administration and other services (7.2% vs 9.7%), financial, real estate and professional services (7.1% vs 4.7%), agriculture (4% vs 3.5%), and manufacturing (1.3% vs 11.1%) .The solid THTC growth reflected the pending catchup to pre-pandemic levels, while manufacturing was hit by surging commodity prices and supply constrains after the Russia-Ukraine conflict. Manufacturing remained much above its pre-pandemic level relative to THTC.

On the demand-side segments, the strongest growth was in exports of goods and services (11.9% in fourth quarter versus 11.1% previous quarter). While slowing global trade impacted goods exports, services exports remained strong. Meanwhile, imports slowed sharply to 4.9% from 10.7%, implying that net exports contributed positively to GDP growth in the fourth quarter. Among domestic demand drivers, the strongest growth was in investment (8.9% vs 8.0%).

Government capital expenditure remained strong, with states raising capex towards the fiscal end. The increasing investment growth also indicates a gradual pickup in private capex. While private consumption expenditure improved, it was more subdued than investment (2.8% vs 2.2%). High inflation may have weighed on household consumption, with CPI-linked inflation remaining elevated at 6.4% in the fourth quarter; staying put as against the previous quarter.

However, for fiscal 2023, private consumption growth was strong at 7.5%, on top of 11.2% in fiscal 2022. Investment growth was vigorous at 11.4%, compared with 14.6%. Imports increased more sharply than exports in the full year, at 17.1% and 13.6%, respectively, illustrating that net exports were a drag on GDP growth. Government consumption spending had slowed sharply to 0.1% from 6.6%, as pandemic spending ebbed.

Domestic macroeconomic outlook for fiscal 2024

Macro variables	FY22	FY23	FY24E	Rationale for outlook
GDP (on-year)	9.1%	7.2%	6.0%	• India's real GDP growth is forecast to decelerate to 6.0% in fiscal 2024 from 7.2% last fiscal, primarily because slowdown in global growth has started to impact India's exports and industrial activity • Domestic demand will also come under pressure this fiscal owing to elevated interest rates, though softening inflation and government capex will provide support. Monsoon and El Nino risk remain swing factors • Interest rates are higher than the pre-pandemic five-year average (fiscals 2016 to 2020), which would moderate domestic demand, especially that of interest-sensitive segments, such as automobile and housing • In fact, CRISIL projects the challenges to spill over into fiscal 2025, with growth projected at 6.2%
CPI-linked inflation (on-year)	5.5%	6.7%	5.0%	• Decline in crude oil prices and export of other key commodities, mainly owing to slowdown in global growth, lowered commodity prices in fiscal 2024, thereby cooling inflation • CPI inflation has moderated in the past few months of this fiscal. The trajectory is mainly because of a strong base effect, which has dampened the impact of headline inflation. Another reason, a fall in global crude oil and commodity prices, and easing supply pressures, leading to better

Macro variables	FY22	FY23	FY24E	Rationale for outlook
				availability of inputs and, therefore, reducing the pressure on prices. Food inflation has also subsided as rabi crop outlook is positive • Hence, CRISIL projects CPI inflation to trend at 5% levels this fiscal vis-à-vis 6.7% last fiscal. A supportive monsoon is the key assumption underlying the forecast, though. In fact, slowdown in economic growth amid moderating inflation may lead to rate cuts by the end of this fiscal
10-year government security yield (March-end)	6.8%	7.4%	7.0%	• Yields on the 10-year G-sec has trended downward after the Monetary Policy Committee unexpectedly halted the rate hike cycle in its April 2023 review. Yields continued to decline in May after the inflation print fell further on the back of fall in crude oil prices, though increase in foreign portfolio investor (FPI) debt purchases provided support at lower levels. Both global and domestic factors contributed towards softening of bond yields • On the domestic front, the yield fell almost 50 bps, the lowest since August 2017, and well below the pre-pandemic five-year average of 95 bps – The 10-year G-sec averaged 7.4% in March 2023 compared with 6.8% in March 2022 • G-sec yields are expected to remain low till the end of this fiscal, in fact trending at 7.0% by March 2024, on the back of moderating inflation, lower crude oil prices and continued pause in the RBI rate hike cycle
CAD/GDP (%)	-1.2	-2.0	-1.8	• India's exports are expected to face headwinds from anticipated slowdown in global growth. Several key economies such as the US and those in the euro area, which are key export markets for India, are facing pressure. Deceleration in domestic growth could also lead to some softening in imports • However, India's robust growth and falling inflation, and easing trade deficit has attracted foreign investors. The sharp fall in crude oil prices ($75.7per barrel in May vs. $84.1 in the April) also augurs well for the domestic economy. FPI inflows increased to $5.9 billion (net) in May, the highest since September 2022. Bulk of the inflow has been directed towards equities, with inflows into debt also improving • Narrowing the trade deficit had a salutary effect on India's current account deficit (CAD) – CRISIL projects India's CAD at 1.8% of GDP in the current fiscal, as exports continue to decline at a sharper pace than imports
Rs/$ (year-end)	76.2	82.3	83	• The rupee continues to face headwinds amid global growth slowdown, heightened geopolitical tensions, elevated commodity prices, and aggressive rate hikes by the US Fed, and continuing strengthening of the dollar amid unfavourable trade deficit • Still, in 2023 so far, the rupee has depreciated a mere 0.5% against the dollar, remaining one of the least depreciated emerging market currencies • But in the past two months, the rupee has come under pressure with the dollar strengthening – Rs-$ exchange rate fell 0.4% on-month to 82.3 against dollar in May • CRISIL expects the rupee to average 83.0 against the dollar in March 2024 compared with 82.3 in March 2023. A surge in FPI flows will restrict the currency from falling further

P: Projected

Source: Reserve Bank of India (RBI), NSO, CRISIL

While growth was robust in fiscal 2023, a slowdown is inevitable in fiscal 2024, driven by rising borrowing costs. While central banks aggressively raised policy rates over the past 15 months, their transmission to broader lending rates is taking place with a lag. Rates are expected to peak in the fiscal, hitting both global and domestic demand. External demand will weaken more with major advanced economies facing the highest interest rates in over a decade. S&P Global expects United States GDP growth to slow to 0.7% in 2023 from 2.1% in 2022; Eurozone will brake to 0.3% from 3.5%. These economies account for 33% of goods exports. Hence, exports will curb the growth in this fiscal. While the rise in domestic interest rates is relatively lower than in advanced economies, bank lending rates have reached the pre-pandemic five-year average. This is expected to moderate domestic demand, especially in interest-sensitive segments such as automobiles and housing.

However, falling commodity prices and slowing inflation augurs well for domestic demand this fiscal. We expect further support from the government's continuing infrastructure spend. The key swing factor is monsoon, which has a significant bearing on rural demand. While the India Metrological Department has forecast a normal monsoon, regional and temporal distribution will have a bearing on agricultural output. Downside risks from an expected El Niño remain.

Because of these factors, CRISIL projects GDP to grow 6% this fiscal, compared with 7.2% in fiscal 2023. Nominal growth will see a sharper slowdown to 10.6% from 16.1%, with falling inflation (particularly for WPI) narrowing the gap between real and nominal GDP.

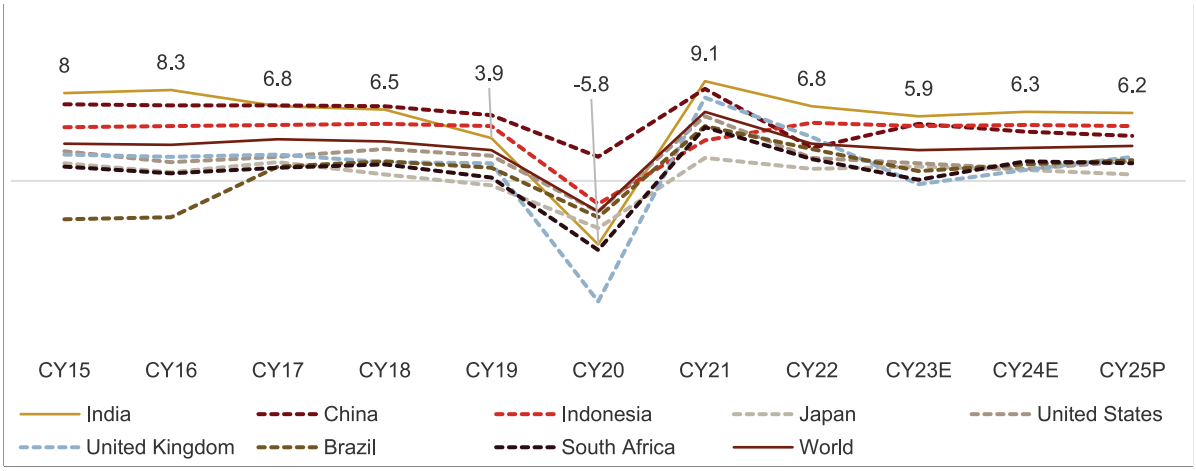
Going ahead, over the long-term horizon, economy is expected to continue its growth momentum and clock 5.5-6% CAGR during fiscal 2023 to fiscal 2028 period.

India to remain an outperformer

Despite the slowdown in the near term, India is expected to remain a growth outperformer over the medium term. CRISIL expects GDP growth to average 6.1% between fiscals 2023 and 2025 compared with the International Monetary Fund's projection of 3.1% for the global economy.

Stronger domestic demand is expected to drive India's growth premium over peers in the medium term.

India is one of the fastest-growing major economies (GDP growth, % on-year)



E: Estimated; P: Projected
Note: GDP growth is based on constant prices
Source: IMF (World Economic Outlook – July 2023 update), CRISIL MI&A

Investment prospects are optimistic, given the government's capex push, progress of the Production-Linked Incentive (PLI) scheme, healthier corporate balance sheets, and a well-capitalised banking sector with low non-performing assets.

India is also likely to benefit from its supply-chain de-risking strategy, as global supply chains get reconfigured with focus shifting from efficiency towards resilience and friend shoring.

Private consumption (~57% of GDP) will play a supportive role in supporting GDP growth in the medium term.

EXIM: Core to the rescue

India's merchandise export continued to decline for the sixth consecutive month in July, and at $32.3 billion, was down 15.9% on-year. If not for a favourable base effect (as exports had fallen substantially on-month last July), the annual contraction this July would have been even larger.

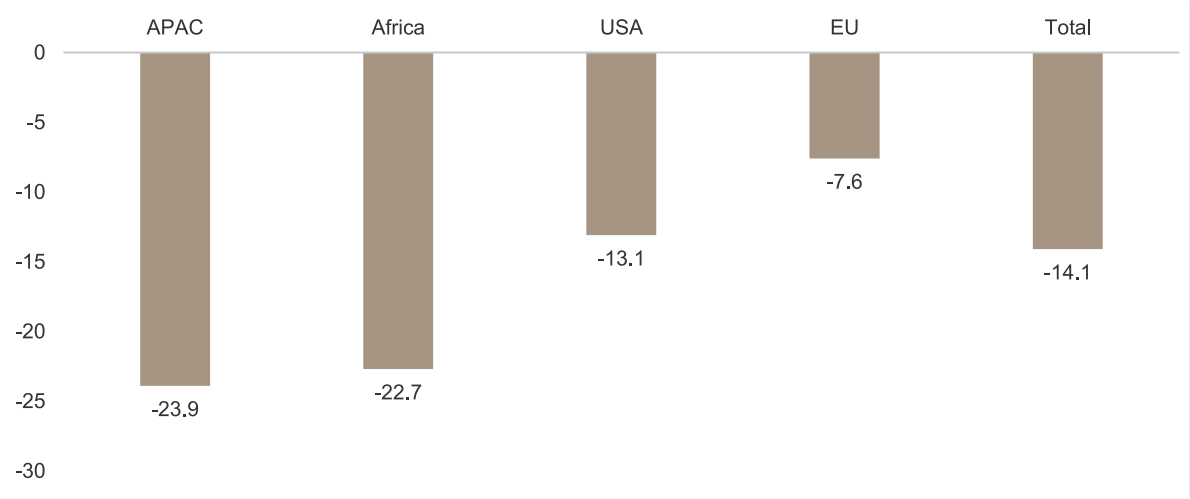
Amid the gloomy export scenario, a couple of things provide some solace:

- First, the export figure for June was revised up a good $1.4 billion to $34.3 billion (from $32.9 billion earlier), which means exports contracted slightly lesser (18.8% from 22.0% earlier)
- Second, the 15.9% contraction in July was largely a result of slowdown in oil exports, which were down 43.8% on-year. Core exports, i.e., non-oil, non-gold exports, though, fell by a much lesser 5.7%. In fact, sequentially and on a seasonally adjusted basis, core exports marginally rose in July, owing to improvement in the export of other key categories, such as engineering goods, and organic and inorganic chemicals, and labour-intensive export categories, such as gems and jewellery, ceramic products and glassware, and a few textile products (carpets, manmade yarn, and fabrics, among others)

That said, the pressure on goods export remains, and the sequential improvement in core exports is unlikely to be sustained as global growth is expected to be slower in the second half this year.

Moreover, the decline appears broad-based, in that goods exports are slowing not only to the West, but also to emerging markets, especially the Asia-Pacific, India's largest regional export destination.

Goods exports growth: April-June 2023 (%, y-o-y)



Source: Ministry of Commerce and Industry, CRISIL

Cumulatively, during April-July 2023, India's merchandise exports fell 14.5% on-year to $136.2 billion, from $159.3 billion in the year-ago period. Merchandise exports are increasingly facing headwinds from the slowdown in goods demand globally, not only in advanced economies such as the US and euro area, but also from emerging markets, most importantly Asia-Pacific. Exports are facing a double whammy from a fall in prices and volumes in many cases.

Merchandise import, too, fell, for the seventh consecutive month in July, and at $52.9 billion was down 17.0% on-year. As in the case of exports, the decline in imports was also led by crude oil. Gold imports fell substantially as well, following the government's move to restrict certain categories of gold imports last month. But compared with overall imports, core imports fell a smaller 7.5%. In fact, sequentially and on a seasonally adjusted basis, core imports registered growth, allaying some of the fears of a domestic demand slowdown setting in, as was indicated by a sharp slowdown in core imports in June. Among others, investment-centric imports such as machinery and machine tools again gained pace.

With a sharper sequential decline in exports vs. imports, merchandise trade deficit rose to $20.7 billion in July, from $18.8 billion in June. That said, it was down from $25.4 billion from that recorded in July last year.

Another positive development is the rebound in services exports. After touching a low of 3.5% in June, services exports grew an estimated 16.8% in July. This suggests that some of the softness seen in services exports recently (likely due to issues in the banking sector in the US and Europe) could indeed be transitory. To be sure, a recent report by information technology (IT) research firm Gartner pointed towards higher IT spends by the banking industry in 2023 (over 2022) globally. This should keep India's services exports in goods stead and its current account deficit (CAD) contained.

That said, an expected slowdown in domestic growth in the second half of this fiscal would keep a check on India's imports. At the same time, services export growth appears to be turning robust again.

As a result, we project India's CAD, which was 2.0% of the GDP in fiscal 2023, to soften to 1.8% this fiscal.

Sharp lift from food inflation amid material comfort from non-food inflation

Consumer Price Index (CPI)-based inflation surged to 7.4% in July from 4.9% in June. Though a sharp rise in inflation was expected, its extent came as a surprise. It was led by 11.5% inflation in food items.

- Though likely to be transient, food price pressures are expected to stay for a couple of months more. July data not only highlighted the surge in prices of vegetables (37.3%), but also double-digit inflation in cereals and pulses (~13% each) and spices (21.6%), and high inflation in milk (8.3%) — all of which is pinching the average consumer's pocket. A normal monsoon provides limited comfort to prices in the immediate term
- There is, however, relief on the non-food front, where inflation has been steadily softening, led by falling input cost pressures. This has reduced the need to raise retail prices for several commodities. In July, goods inflation (excluding food) slid 20 bps on-month to 5.1%, while services inflation softened 20 bps to 4.5%. Excluding vegetables, CPI inflation was up only 10 bps on-month, at 5.5%, while excluding the entire food category, CPI inflation was down 25 bps, at 4.8%
- Yet, for now, the pressure from food prices remains the big worry and can cause the headline inflation to run red hot for another 2-3 months, after which government intervention (releasing food stocks, facilitating imports and restrictions on hoarding) and fresh crop arrivals should provide some relief

Food inflation is raging, mainly in vegetables

The steep rise in food inflation to 11.5% in July from 4.5% in June and 3% in May was because of accelerating inflation in vegetables, cereals, pulses, spices, and milk. This is the highest rate of food inflation since April 2020. Sequentially, food prices rose 5.6% on-month on a seasonally adjusted basis, with an uptick seen across most food items. Inflation in edible oils remained in the deflation zone (-16.8%), providing some offset.

- Vegetables inflation, which was in the deflation zone for eight straight months, surged to 37.3% in July from -0.7% in June, led by a sharp increase in tomato prices. On a seasonally adjusted basis, vegetable prices shot up 28% on-month (vs 5.2% in June). Tomato inflation zoomed to 201.5% (vs -34.1%). Sequentially, too, tomato prices increased 195.3% on a seasonally adjusted basis. Inflation in onions accelerated to 11.7% (vs 1.7%). Other vegetables such green chillies, garlic, carrot, radish, brinjal, cauliflower, okra also saw double-digit inflation. Deflation in vegetable prices was helping keep the headline food number low over the past few months despite high inflation in other major food categories such as cereals, pulses, and milk
- Inflation in cereals rose to 13% in July from 12.8% in June, led by accelerating inflation in rice (14% in non-PDS rice) which has the highest weight among cereals. On the other hand, inflation in wheat from non-PDS sources eased to 11.9% from 12.4%, led by arrival of rabi stocks
- Inflation in pulses rose to 13.3% from 10.6% in the previous month as inflation in tur (34.1% vs 27.5%) and moong (9.1% vs 7.5%) picked up. Prices of pulses rose 2.7% on-month (seasonally adjusted). Among other protein categories, inflation eased in eggs (3.8% vs 7%), stayed high in milk (at 8.3% vs 8.6%), but hardened in the meat and fish category (2.3% vs 1.5%)
- Inflation in spices accelerated to 21.6% in July from 19.2% in June. Inflation in jeera, black pepper, and tamarind also picked up

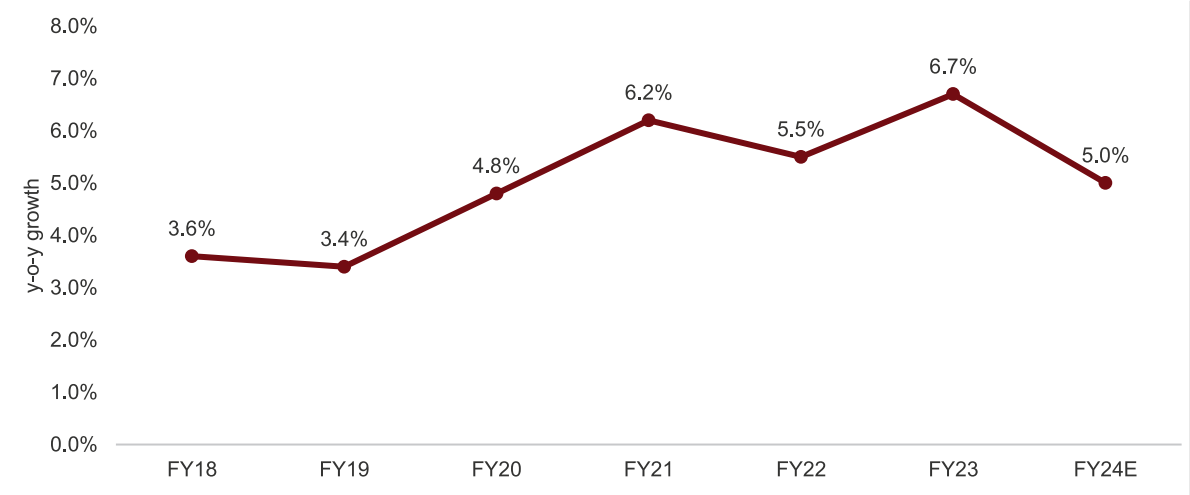
Fuel inflation eases marginally

- Fuel inflation eased marginally to 3.7% from 3.9% despite an on-month rise in global energy prices as the base effect continued to be supportive. While global energy prices increased on-month, they fell 41.3% on-year
- Inflation in kerosene from both PDS (-32.3% vs -26.8%) and non-PDS sources (21.3% vs 29.1%) cooled. Inflation in the wood and fire chips category (4.6% vs 4.8%) also slowed marginally
- Inflation in electricity rose to 13.4% from 8.7%

Core inflation slows

- Core inflation slowed to 4.9% in July from 5.2% in June, driven by softening inflation in clothing and footwear (5.6% vs 6.1%) and housing (4.5% vs 4.6%)
- Inflation remained fairly stable, but high in personal care and effects at 9%, health at 6.2%, and gold at 16.7%; and surged for silver (at 19.9% vs 12.9%)
- Inflation in education cooled to 5.5% from 6.0% with softening inflation in educational fees (5.7% vs 6.4%)
- Core goods inflation (excluding food) eased to 5.1% from 5.3%, while services inflation cooled to 4.5% from 4.7%

CPI inflation trend



Source: Ministry of Statistics and Program Implementation (MOSPI), CRISIL

Outlook

CRISIL MI&A believes monsoon disturbances amid already high inflation rates for certain food items are lending an upside to the inflation outlook. However, for now, CRISIL continues to retain CPI inflation forecast at 5% average for fiscal 2024 (against 6.7% in fiscal 2023). Both July and August are critical for agriculture. Progress of the monsoon remains a key monitorable.

Dealing with inflation caused by supply-side shortages — as it is now — is outside the purview of monetary policy. Here, fiscal policy can play an important role. Interventions such as release of stocks, facilitating imports, restrictions on hoarding can help contain abnormal price spikes in the short term. That said, a transitory rise in food inflation is usually ignored by the Reserve Bank of India (RBI). But a sustained increase can become a concern. CRISIL expects the RBI to keep rates and stance unchanged in the forthcoming policy meet. Rate cuts are expected early next year.

Industrial recovery weakens in June

Industrial output measured by the Index of Industrial Production (IIP) rose 3.7% on-year in June, compared with 5.3% in the previous month. Steady growth in mining and rise in electricity output was pulled down by a slowdown in the manufacturing sector.

Consumer-oriented sectors take a beating

- The consumer non-durables sector showed feeble growth (1.2% in June vs 8.4% in May)
- Consumer durables growth turned negative (-6.9% vs 1.2%), driven by waning support from automobiles (7.9% vs 13.4%). IIP declined further for wearing apparel (-23.3% vs -20.9%) and electronics (-32.0% vs -5.7%)
- Looking at export-linked sectors such as textiles (-0.3% vs -3.7%) and chemical products (-2.2% vs -2.1%), growth remains deficient. Growth in pharmaceuticals slowed, too (6.7% vs 20.9%)
- Capital goods slowed significantly (2.2% vs 8.1%), reflecting the drag from falling exports of engineering goods
- However, growth in commodity-linked sectors such as basic metals (13.6% vs 9.6%) and petroleum products (3.1% vs 2.5%) remains resilient

- Infrastructure and construction goods IIP stayed steady (11.3% vs 11.3%). Primary goods (5.2% vs 3.6%) and intermediate goods (4.5% vs 3.0%) showed a sharp revival

Outlook

In the first quarter of this fiscal, IIP growth averaged 4.5% on-year, the same as in the previous quarter. Consumer-oriented sectors, infrastructure and construction were the main drivers of growth.

Overall manufacturing activity remains healthy, as evident in S&P's Purchasing Managers' Index being in an expansionary zone (above 50) till date. It stood at 57.7 in July, similar to 57.8 in June.

That said, two factors could affect the direction of industrial performance in coming months. First, a global economic slowdown — if not a recession — remains on the cards under the weight of rising interest rates. S&P Global expects this to lead to a shallow, but more protracted slowdown from the second half of 2023. Due to this, exports may remain a drag on industrial activity.

Second, the monsoon's performance will critically influence industrial prospects through impact on inflation and rural demand. The monsoon has weakened again, with all-India rainfall turning deficient at 5% below long period average (LPA) as on August 15. El Nino has set in as expected, and its timing and intensity will determine rainfall patterns this year.

Overall, CRISIL expects GDP to grow 6.0% this fiscal compared with 7.2% the previous fiscal.

Rupee holding steady

The rupee shrugged off some of the weakness seen in May and recorded mild appreciation in June, even as the dollar strengthened. In fact, the rupee was one of the few emerging-market currencies that appreciated against the dollar in June. From averaging 82.30 against the dollar in May, the rupee appreciated 0.1% on-month to 82.23 in June. On a point-to-point basis, the rupee appreciated to 82.04 against the dollar at end-June from 82.68 at end-May.

With this, the rupee is down a mere 0.4% against the dollar in the calendar year so far (i.e., June over January in average terms), becoming one of the best-performing emerging-market currencies (that said, there are a few currencies, such as the Indonesian rupiah and Brazilian real that have appreciated against the dollar this year).

The rupee displayed resilience in June. It was one of the few emerging-market currencies that appreciated against the dollar. The Brazilian real appreciated as well, maintaining its healthy gain against the dollar as the country's economy benefits from robust growth prospects amid improving reform outlook.

Closer home, the Chinese renminbi's depreciation accelerated in June owing to faltering economic growth. It depreciated 2.5% on-month in June, compared with 1.4% in May. On balance, the rupee is one of the least depreciated emerging-market currencies so far this calendar year (see chart below). The Indonesian rupiah and Brazilian real have appreciated.

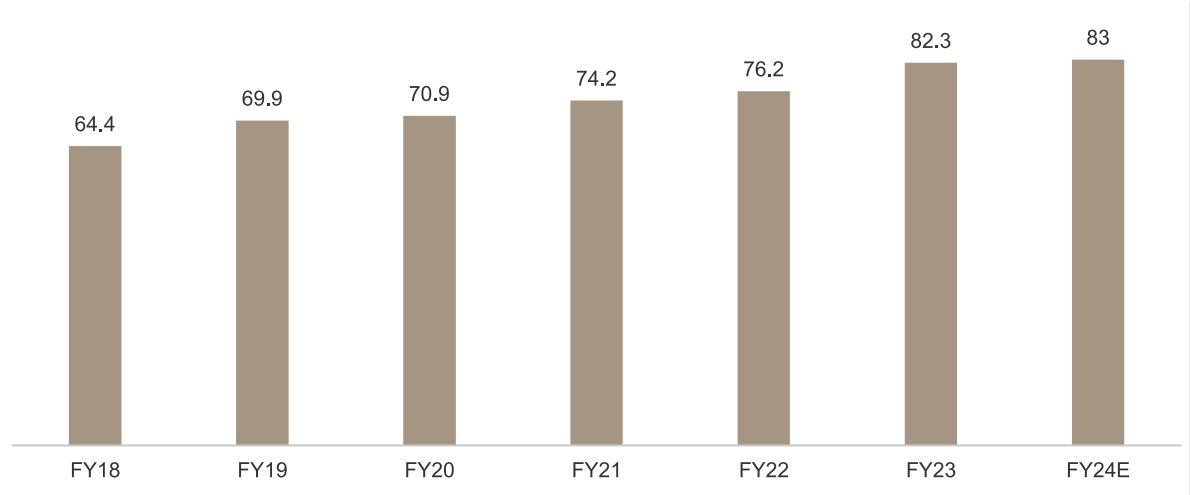
Among advanced-economy currencies, the British pound continued to display strength and gained 1.1% against the dollar in June, driven by continued monetary policy tightening, even as the US Fed has halted rate hikes for now.

While the European Central Bank continued to hike rates in June, weaker growth data from Germany — a key economy — led to depreciation of the euro. The Japanese yen fell the most, depreciating 3.1% against the dollar, as the Bank of Japan stuck to its easy monetary policy stance amid rapidly rising policy rates globally.

Outlook

The rupee is likely to average 83 against the dollar in March 2024, versus 82.3 in March 2023. It is projected to depreciate only mildly this fiscal, as compared with last fiscal. While a lower current account deficit will support the rupee, volatile external financing conditions could exert pressure on the currency.

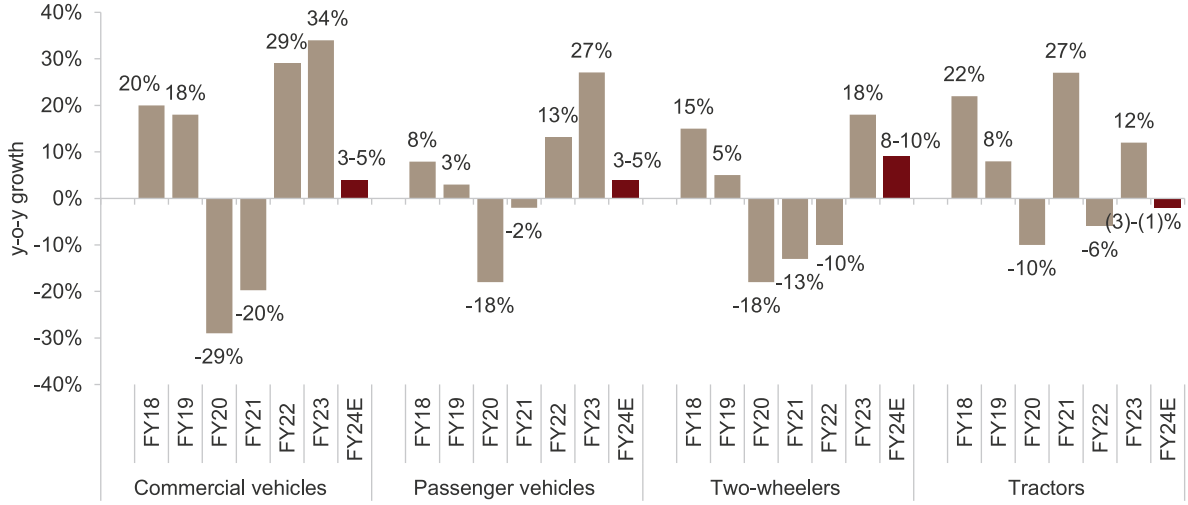
Rupee-dollar exchange rate



Source: RBI, CRISIL

2 Automobile industry

Domestic Sales projections for various automobile segments



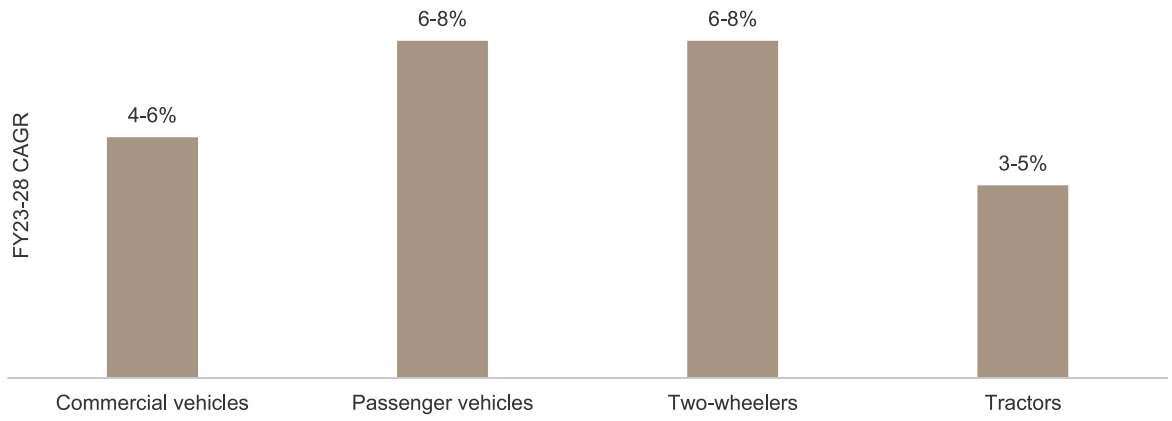
Source: SIAM, TMA, CRISIL MI&A

All automobile segments witnessed healthy growth in fiscal 2023 amidst normalised mobility, improved macroeconomic scenario, favourable rural demand as well as healthy demand from end-use sectors. Total automobile industry (commercial vehicles, passenger vehicles, two wheelers & tractors) domestic sales witnessed 20% growth during fiscal 2023. Off this high base, some tapering in the growth rate is expected in fiscal 2024 across segments. Minor contraction is expected in the tractors segment. Overall automobile industry domestic sales growth is expected to taper to 7.5% during fiscal 2024.

- Demand for commercial vehicles will be supported by increased government spending and robust replacement demand. Key end-user sectors, notably construction and mining will sustain their strong demand, contributing to this upward trend.
- Healthy order book, continued traction for UVs, easing supply constraints, new UV segment launches, strong sales from existing models as well as a favourable macroeconomic scenario will support further growth in passenger vehicles.
- Two-wheeler demand to be led by improvement in incomes, favourable urban demand, premiumisation, steady rural traction, easing inflation and continued financing support. Domestic tractor sales are expected to contract marginally on-year on account of elevated inventory levels and subdued farmer sentiments.
- Crude oil prices have continued to be on an upward trajectory since end-2021. They rose even higher with the Russia-Ukraine conflict, which led to prices averaging $100 per barrel (bbl) in 2022. Going forward, with further de-escalation of the crisis and balancing of global crude oil trade, CRISIL MI&A expects prices to cool further, settling at $75-80 per barrel in 2023. However, any decision by the Organization of Oil Exporting Countries (OPEC) to cut production as well as a further decision on the ban of Russian crude are the key monitorables that would impact global crude prices.
- Rabi output was favourable in fiscal 2023, supporting farmer incomes during the early months of fiscal 2024. In the current fiscal, kharif sowing was initially delayed owing to the delay in monsoon. However, sowing has picked up in recent months. Moreover, higher MSP allocation for fiscal 2024 and good prices in mandis have

maintained the positivity on-ground. Going ahead, the rainfall progress and spread will play a key role for the current kharif cycle. The progress of the monsoon and its impact on rural demand, especially for two-wheelers and tractors, remain key monitorables.

Domestic long-term sales projections for various automobile segments (fiscal 2023-fiscal 2028 CAGR)

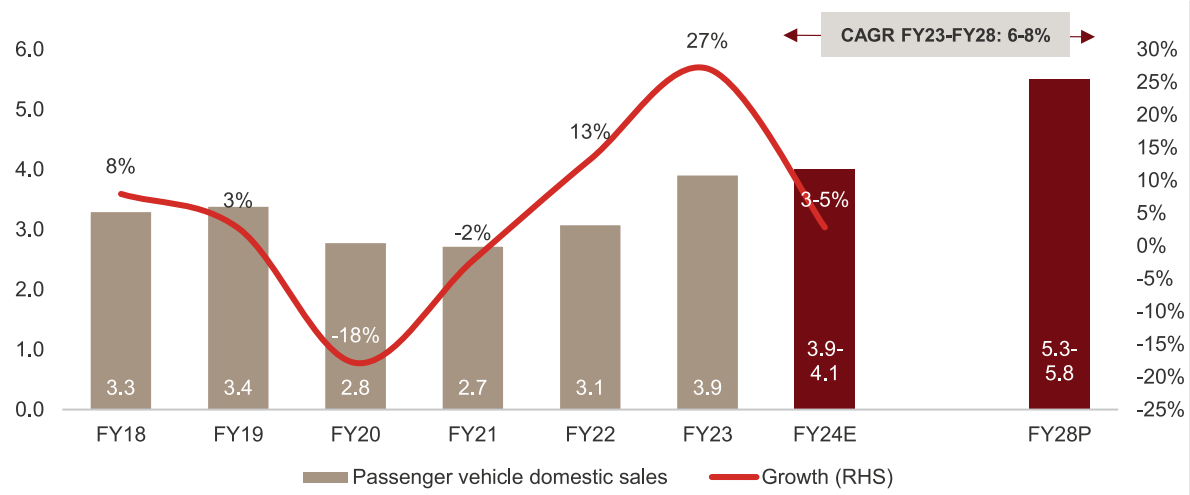


Source: SIAM, TMA, CRISIL MI&A

- Over the long-term horizon, healthy macroeconomic growth, increasing disposable income, infrastructure investments, government support to rural incomes, favourable monsoons, moderate inflation, continued financing support, as well as a deeper reach in the rural markets will support the domestic sales growth of automotive industry. Moreover, intermittent vehicle launches will provide an additional boost to the automotive industry demand.
- CRISIL MI&A expects the domestic sales of the industry to grow at 6-8% CAGR to reach 30-32 million levels by fiscal 2028. The larger two-wheeler and passenger vehicles segments are projected to grow at a faster pace of 6-8% while commercial vehicles and tractors to grow at a relatively slower pace of 4-6% and 3-5% CAGR respectively during fiscal 2023-fiscal 2028 period.

3 Passenger vehicles

Industry growth momentum to continue, albeit at a slower pace, backed by a healthy order book, easing supplies and traction from new model launches



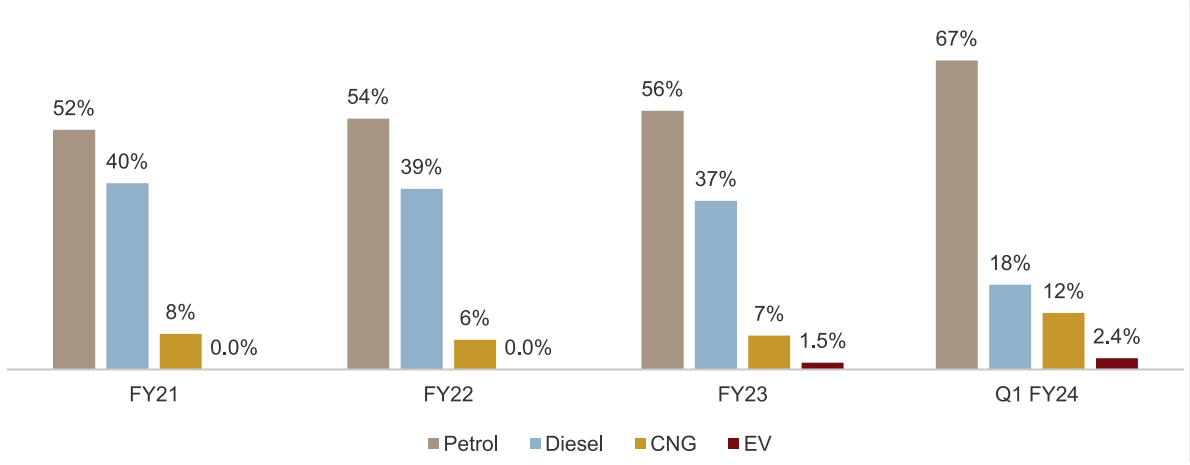
Source: SIAM, CRISIL MI&A

- In fiscal 2023, PV domestic sales grew 27% on-year (almost doubled from 13% in fiscal 2022) due to healthy pent-up demand following a slump in sales volumes for two years owing to pandemic-led supply chain disruptions. The orderbooks of auto OEMs were further supported by a plethora of launches in the growing UV category, which witnessed high traction. Further, multiple facelifts to existing models and easing semiconductor supplies drove record sales in each quarter in fiscal 2023. The overall wholesale volumes reached a historic high of ~3.9 million units in fiscal 2023. Although, semiconductor shortage and in turn the vehicle supply constraints, increased fuel costs, elevated interest rates limited the growth in domestic sales during the fiscal.
- Domestic sales of passenger vehicles rose at a 3% CAGR between fiscals 2018 and 2023. From fiscal 2018 to fiscal 2021, sales contracted at a 6% CAGR. From this low base, industry sales rebounded to reach 3.9 million units in fiscal 2023
- The previous high was reached in fiscal 2019 led by a continued improvement in GDP, an increase in disposable income, new model launches, stable cost of vehicle ownership as well as rising traction for the UV segment. The drop in economic growth put pressure on vehicle sales in fiscal 2020. Moreover, the NBFC crisis as well as the reduction in Bharat Stage (BS) IV vehicle production amid the mandatory implementation of BS VI norms from fiscal 2021, exerted added pressure during the year. The industry also lost nearly half month's sales during the year end due to the emergence of the pandemic and the subsequent lockdown
- Domestic sales in fiscal 2021 were marred by the first wave of the pandemic. Further, the national lockdown, reduced mobility, supply constraints amid production cuts weighed on annual sales. Despite some improvement in sales with reopening of the economy and increased need for personal mobility during the second half of the year, sales contracted ~2.2% on an already low base of fiscal 2020
- Fiscal 2022 began with a much severe second wave of the pandemic. Nationwide lockdown, economic uncertainty, struggling vehicle supply, semiconductor availability increased waiting period impacted sales, especially in the first half the year. There was some improvement in the economic scenario and, in turn, market

sentiments with reopening the markets in the second half of the fiscal. Pent-up vehicle demand, increased need of personal mobility, an improvement in supply scenario provided the thrust to passenger vehicle demand during the second half. After declining consecutively for two years, passenger vehicle sales rose 13% on a low base of fiscal 2021

- Industry domestic sales reached an all-time high of 3.9 million units in fiscal 2023
- In fiscal 2024, PV industry's growth is expected to moderate due to the high base effect of 27% growth in fiscal 2023 (compared with 13% in fiscal 2022). Nonetheless, the industry is projected to grow 3-5% in fiscal 2024, supported by a healthy order book, continued traction for UVs, easing supply constraints, new UV segment launches, strong sales from existing models as well as a favourable macroeconomic scenario
- During the year, the car segment's domestic sales are expected to contract 4-6%, while UV and van sales are expected to grow at a healthy pace of 10-12%
- Over the long term horizon, domestic PV sales are expected to increase at 6-8% CAGR over fiscals 2023-2028. Healthy macroeconomic growth, increasing disposable income, a modest increase in the cost of vehicle acquisition, favourable financing scenario, as well as a deeper reach in the rural markets, tier-III and tier-IV cities will support this growth. Moreover, intermittent feature rich competitively priced vehicle launches will provide an additional kicker to the industry demand.
- Other factors that would aid demand are increasing urbanisation, government support to farm income, lowering of vehicle holding period and electrification. However, increasing congestion in cities and rising popularity of shared mobility services are likely to restrict car sales in the long term.

Rising CNG penetration in India



Source: Industry, MoRTH, CRISIL MI&A

- Amid the sharp rise in petrol and diesel prices, the incentive to opt for CNG vehicles has been increasing. Moreover, recent launches in the CNG space including in the premium hatchback segment have supported CNG penetration
- Prices of CNG increased to Rs 75-86 per kg in metros at the beginning of August 2022 compared with below Rs 50 per kg a year ago. However, CNG prices have moderated in fiscal 2024 as per the recommendations of the Kirit Parekh committee, providing a thrust to the share of CNG vehicles in the current fiscal

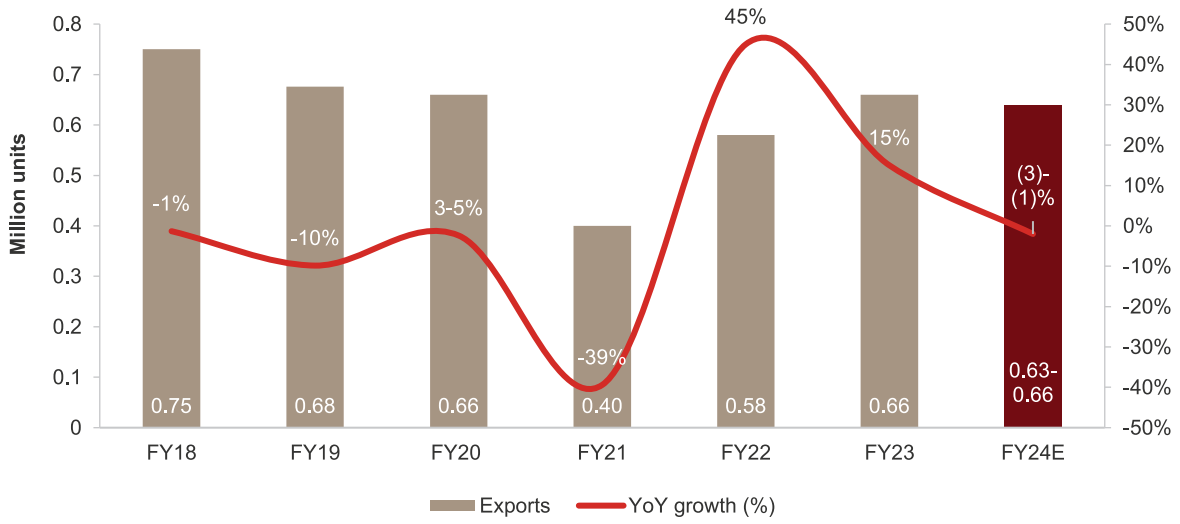
- CNG has largely substituted diesel in the compact car space and has turned into not only a cost-effective alternative, but also a cleaner option for the environment
- Industry remains positive for the CNG powertrain over the long-term horizon led by expanding infrastructure, subdued prices and vehicle launches

Global headwinds to dampen PV exports in fiscal 2024

- Exports grew ~15% in fiscal 2023 owing to demand from emerging countries supported from a push from major OEMs. Latin America and Africa dominated the demand for Maruti Suzuki's Baleno, S-Presso and Dzire models
- Overall exports of Maruti stood at 2.55 lakh vehicles, enabling it to account for ~39% of overall exports and making it the biggest PV exporter. Hyundai (23%), Kia (12%) and Nissan (9%) secured second, third and fourth spots in exports, respectively. An improved performance and subsequent recognition in emerging markets of small cars from Maruti *(Dzire, Baleno, S-Presso and Swift)* as well as UV models from other players (*Creta, Seltos and Sonet*) have led to an increase in exports
- Passenger vehicle exports from India are projected to contract marginally by 1-3% in fiscal 2024 due to moderation in trade across global economies, which is directly linked to the economic slowdown. The slowdown is anticipated to lead to reduced consumer spending and investments in various regions, subsequently impacting merchandise trade volumes and posing significant challenges for India's export prospects. Moreover, lack of foreign exchange in these countries is expected to exert added pressure on Indian exports.

  As a result, the overall demand for India-made passenger vehicles in international markets is likely to remain under pressure during this period

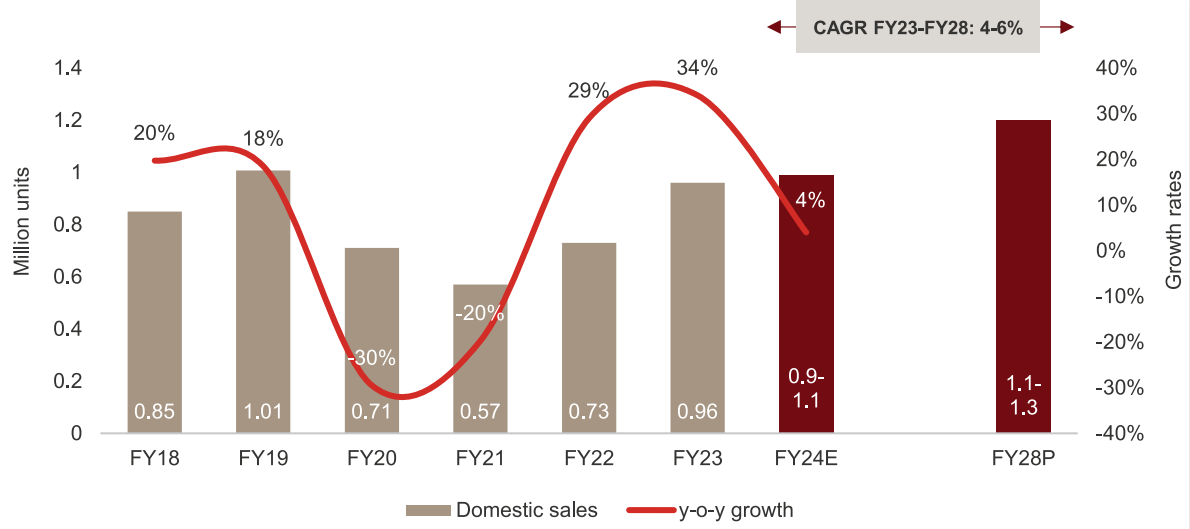
Exports trend



Source: SIAM, CRISIL MI&A

4 Commercial vehicles

Commercial vehicle industry domestic volumes set to reach pre-pandemic levels in fiscal 2024



Source: SIAM, CRISIL MI&A

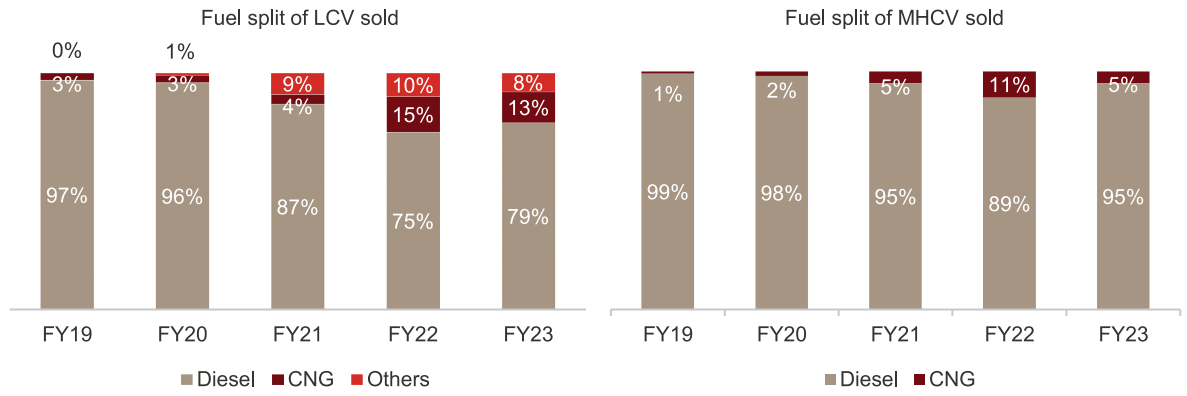
- The CV industry exhibited a noteworthy recovery in fiscal 2023, growing 34% and reaching 96% of the pre-pandemic levels attained in fiscal 2019. This resurgence can be attributed to pent-up replacement demand that had been hampered during the preceding 2-3 years due to economic stagnation and the disruptive impact of the pandemic
- Industry is projected to experience resilient growth in fiscal 2024, surpassing pre-pandemic levels supported by increased government spending, robust replacement demand, and higher traction in end-use sectors such as construction and mining
- In the initial quarter of fiscal 2024, overall CV sales experienced a marginal decline of 3% compared with the corresponding period of the previous year. This downturn was influenced by prebuying activity that occurred in the fourth quarter of the preceding fiscal year, ahead of the implementation of BS VI stage II, which entailed a price hike of 3-5%. Moreover, supply-related constraints emerged due to the technological transition undertaken by OEMs to comply with the new standards
- Sales growth is expected to be 3-5% in fiscal 2024, reaching pre-pandemic levels recorded in fiscal 2019. This trajectory is expected to be underpinned by increased government spending and robust replacement demand. Key end-use sectors, notably construction and mining, are anticipated to sustain their strong demand, contributing to this upward trend

Growth expected across end-use segments

Segments	FY18	FY19	FY20	FY21	FY22	FY23E	FY24P
Coal (production)	2	7	0	(2)	9	17	5-6
Iron ore (production)	3	3	19	(17)	23	0-2	6-8
Steel (consumption)	8	9	1	(5)	11.4	12-13	7-9
Cement (consumption)	9	12	(3)	1	9	11-12	8-10
NHAI roads (km constructed/day)	8	9	11	11	13	13-14	15-16
Port (traffic)	6.5	8.2	2	(5.5)	4.3	8-9	3-6

Note: Values are % growth on-year
Source: CSO, RBI, SIAM, CRISIL MI&A

Changing tides: CNG price hike hurts market share in LCVs in fiscal 2023



Note: LCV: 0-7.5T MHCV: >7.5T
Source: MoRTH, CRISIL MI&A

- The adoption of CNG in the light commercial vehicle (LCV) segment faced challenges in fiscal 2023 due to a significant 57% increase in CNG prices relative to a minor 2% rise in diesel prices. As a result, the gap between CNG and diesel prices narrowed, leading to a reduction in total cost of ownership (TCO) benefits of CNG models. Consequently, the LCV segment observed a marginal decline in the share of CNG vehicles, indicating a possible shift in consumer preferences
- The share of CNG models in the LCV market dropped from 15% in fiscal 2022 to 12% in fiscal 2023. Similarly, in the medium and heavy goods vehicle (MHGV) category, the share of CNG MHGV vehicles sold reduced from 11% in fiscal 2022 to approximately 5% of total sales in fiscal 2023. The increased cost of CNG compared with diesel impacted demand, prompting consumers to opt for diesel-powered vehicles instead
- During fiscal 2022, low CNG prices, launch of CNG models as well as CNG infrastructure expansion supported growth of CNG share for MHCV segment
- In fiscal 2024, CNG prices have declined 4% to Rs 74/kg owing to the recommendations of the Kirit Parekh Committee. The price decline will open up the difference in total cost of ownership between diesel and CNG vehicles, favouring CNG transition

- The long-term prospects for CNG adoption remain promising. Fluctuating fuel prices and government incentives for eco-friendly alternatives could potentially reignite demand for CNG-powered vehicles. Moreover, advancements in CNG technology and the expansion of refuelling infrastructure may enhance the appeal of CNG models, offering a greener and more sustainable solution for the transportation sector

Medium and heavy commercial vehicles to thrive in the coming five years

The MHCV industry is expected to grow significantly, with a compound annual growth rate (CAGR) of approximately 3-5% projected from fiscal year 2023 to fiscal year 2028.

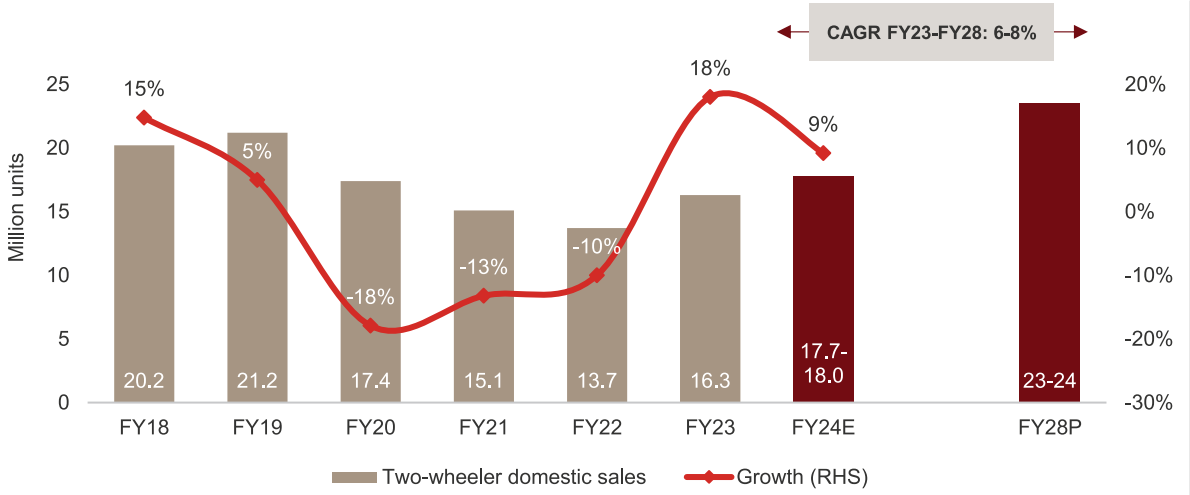
Long-term MHCV sales are likely to be driven by several factors, including the country's improving industrial activity, consistent agricultural output, and the government's continued emphasis on infrastructure development. However, volume growth may be limited due to efficiencies gained from the implementation of the Goods and Services Tax (GST), the development of improved road infrastructure, and the commissioning of the dedicated goods corridor (DFC). Nonetheless, the industry remains on a promising growth trajectory in the coming years.

Light commercial vehicle (LCV) demand is expected to grow at a 2-6% CAGR from fiscal 2023 to fiscal 2028, owing to increased private consumption, lower penetration, increased availability of redistribution goods, and improved financing. The industry grew at a 4% CAGR between fiscal 2018 and 2023. Domestic bus sales are expected to grow at a CAGR of 6-9% between fiscal years 2023 and 2028. Increased demand for inter-city/state travel, aided by improved road infrastructure, and higher personal disposable incomes will drive growth.

Overall, the commercial vehicle domestic sales are projected to grow at 3-5% CAGR during fiscal 2023-2028 period.

5 Two-wheelers

Two-wheeler sales to maintain recovery momentum in fiscal 2024 on an elevated base of fiscal 2023



E: Estimated P: Projected
Source: SIAM, CRISIL MI&A

- Two-wheeler volumes are projected to improve 8-10% in fiscal 2024 after robust growth of 18% in fiscal 2023
- Motorcycle sales will be driven by improving income sentiments, a pickup in rural income with real rural wages turning positive. Furthermore, forecasts of a normal monsoon are likely to have a positive impact on the demand for motorcycles. Scooter sales will be driven by the continued shift on account of 'scooterisation' with a reduction in FAME subsidy restricting a further rise in electric sales
- Despite projected growth, volumes in fiscal 2024 are still expected to remain around 15% lower than the peak achieved in fiscal 2019. The reason for restricted growth is a significant price hike witnessed in the two-wheeler segment over the past few fiscals, affecting both ownership and acquisition costs and subsequently dampening consumer sentiment
- The acquisition price for an entry-level two-wheeler has surged 40-45% since fiscal 2019 due to the implementation of safety norms, BS-VI compliance, and higher input costs

Two-wheeler sales to improve in fiscal 2024 due to:

- Continued demand recovery following reopening of offices and educational institutions post pandemic
- Normalisation of economic activities
- Rural traction amid forecasts of a normal monsoon and increased consumer spending
- Robust festive season demand
- Multiple EV model launches by leading OEMs
- Softening inflation
- Income catching up with price hikes and inflation

Headwinds to demand recovery could be:

- El Nino impact on monsoon and rural income sentiments
- Price hikes due to On Board Diagnostics- OBD 2 norms, leading to a 3-5% increase in asset costs
- Reduction in FAME subsidy has made EVs more expensive, potentially affecting EV penetration

Gradual improvement expected in two-wheeler industry

Parameters	Impact			
	FY21	FY22	FY23	FY24E
Income share for discretionary spending	NF	NF	F	F
Cost of ownership	NF	NF	NF	NF
Financing	N	N	N	N
Inventory	N	NF	N	N
Model launches	N	F	F	F
Regulations	NF	N	N	NF
Impact on overall sales growth	NF	NF	N	N

Note: F: Favourable, N: Neutral, NF: Not favourable
Source: CRISIL MI&A

Rural demand recovered in fiscal 2023 after being under pressure in previous years, expect the recovery to continue in fiscal 2024

- Rural income growth is an important determinant of two-wheeler demand. Rural income is a major driver of motorcycle sales as rural areas account for 55-60% of total sales. Motorcycles account for ~66% of overall two-wheeler volumes, whereas scooters account for ~31% with mopeds accounting for the rest
- In fiscal 2024, farm family income is expected to decline marginally. However, other sources of income such as MNREGA, remittances will improve leading to an uptick in income
- CRISIL analysis of income per farm family indicates cultivation, the Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MGNREGA) scheme and dairy account for 45-50% of the total income. In fiscal 2023, it increased ~10% due to higher acreage, productivity, and increased government procurement. Income from MGNREGA reduced ~9% on-year, whereas income from dairy increased on-year on account of increased production and realisation. The remaining share of rural income comes from activities such as construction, poultry, and other informal jobs where CRISIL estimates the income levels to have contracted

Improving petrol consumption indicates a recovery in personal mobility

- Urban demand sentiments improved in fiscal 2023 and the first quarter of fiscal 2024 in line with reopening of offices and educational institutions, which boosted scooter sales. Petrol consumption improved 13% on-year in fiscal 2023 and was 20-25% higher on-year compared with pre-pandemic levels. Consumption improved further by 7% on-year in the first quarter of fiscal 2024.

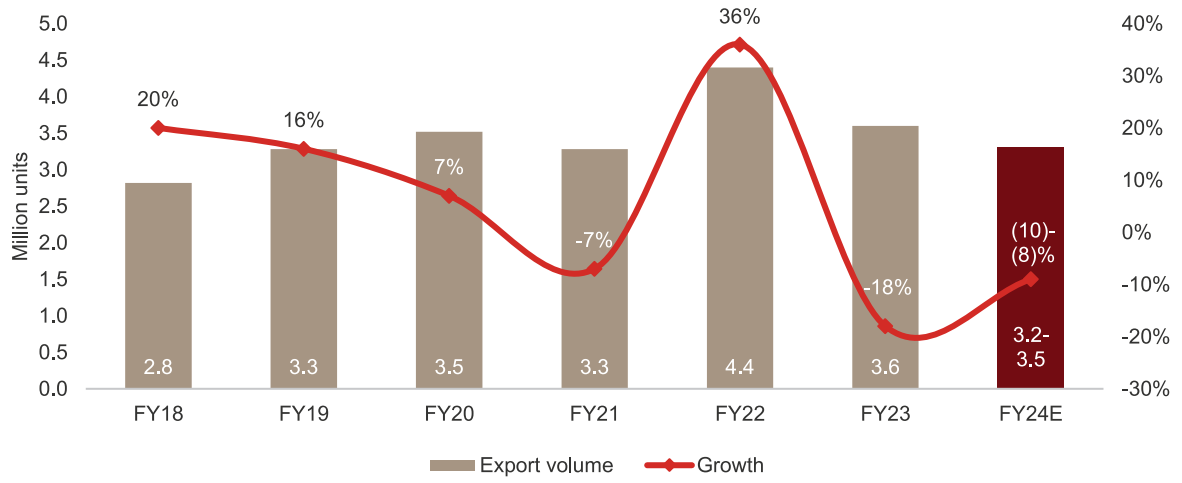
Urban and semi urban markets to steer long-term growth

CRISIL MI&A expects domestic two-wheeler sales to record a compound annual growth rate (CAGR) of 6-8% from fiscal 2023 to fiscal 2028 post a robust recovery in fiscal 2023.

In the medium to long term, we expect manufacturers to focus on expansion in distribution network in semi-urban and rural areas, new model launches for scooters (125 cc) and premium segment for motorcycles.

- Improving rural productivity, diversification towards horticultural crops, government income support schemes and structural measures taken by the government such as PM-KISAN, eNAM, Pradhan Mantri Fasal Bima Yojna (PMFBY) to name a few, will aid rural income in the long run. This is expected to drive sales of motorcycle segment, which will be a primary beneficiary of the rural growth.
- Scooters are expected to witness higher penetration in the rural market (scooters have an urban market share of ~65-75%) which will drive growth. The consumer preference shifting towards higher 'cc' scooters (125cc) is also likely to aid demand. This is due to a ramp up seen in road construction over the last few years. However, EV penetration is going to eat up scooters market share in the long run.
- Mopeds, which account for 3-5% of domestic two-wheeler sales, are expected to decline the long run. Shift in consumer preference towards other vehicle segments and EV penetration will act as key reasons impacting moped sales.
- Increasing EV traction supported by expanding EV portfolio, rising customer awareness, improving infrastructure support, will provide further impetus to the two wheeler segment's domestic growth

Two-wheeler export volumes to decline a further 8-10% on-year this fiscal after declining 18% last fiscal

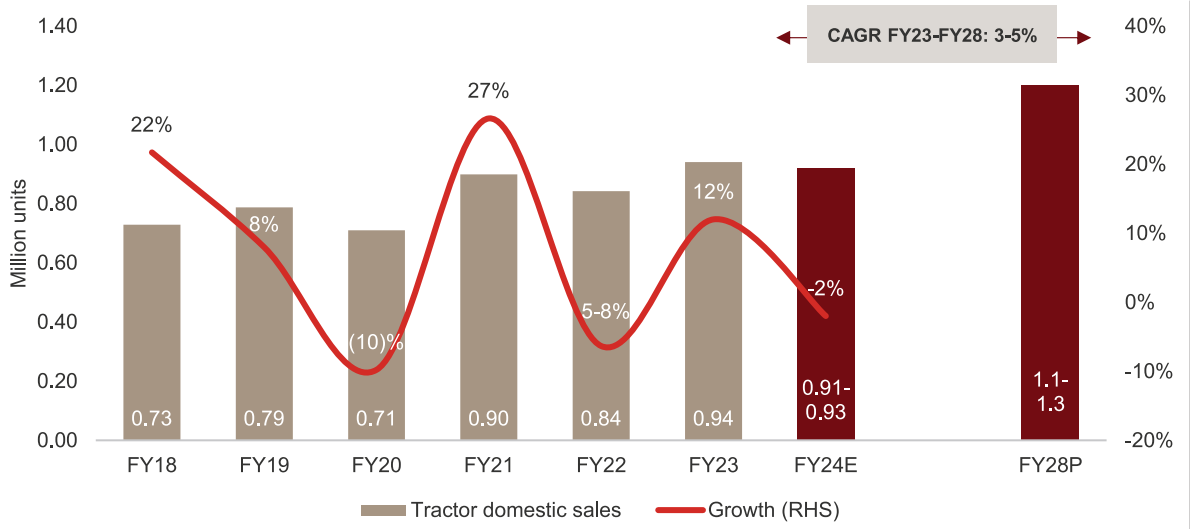


E: Estimated
Source: SIAM, CRISIL MI&A

- Demand pressure in major export destinations has arisen due to global tightening and high inflation, contributing to adverse effects on economic growth and customer sentiment. This is expected to further impact export growth in fiscal 2024. The devaluation of currencies against the Indian rupee and US dollar has resulted in increased product costs.
- While ASEAN countries have experienced a lesser impact compared with African and LATAM economies, both regions have been affected by the prevailing global tightening and worsening economic conditions. The significant devaluation of currencies in a few countries has led to higher retail prices, particularly in the automotive sector.
- Due to the global slowdown, CRISIL MI&A forecasts a continued decline in export demand this fiscal, following a substantial decline last fiscal.

6 Tractors

Domestic tractor industry domestic sales set to decline marginally in fiscal 2024 from the high base of fiscal 2023



E: Estimated P: Projected
Source: TMA, CRISIL MI&A

- Domestic tractor demand dropped 6.4% on-year in fiscal 2022 after growing 27% in fiscal 2021. Rising tractor prices amid price hikes taken by OEMs, higher inventory at dealerships, lower commercial demand, negative farmer sentiment due to rising cultivation cost, low fertiliser availability, and increase in other expenditure (such as marriages and other social occasions) hampered demand.
- In fiscal 2023, domestic tractor sales grew 12% on-year to an all-time high of ~945,000 units. Healthy crop prices, sound reservoir levels due to an above-normal monsoon season, higher MSP announcement and rabi acreage, all led to positive farmer sentiment in the fiscal. Healthy festive demand due to various schemes and discounts supported retail growth momentum.
- This fiscal, CRISIL MI&A expects domestic tractor sales to decline 1-3% on-year on account of elevated inventory and negative farmer sentiment. Delayed monsoon, which was 37% below normal as of June 2023, has negatively impacted farmer sentiment. Weaker retail momentum due to lower rabi profitability which is expected to decline 13-15% on-year amid a decline in yield and lower prices of wheat and mustard. Elevated inventory levels at the end of fiscal 2023 will lead to inventory liquidation in fiscal 2024 and negatively impact wholesale demand. A pick-up in commercial activities and an anticipated increase in replacement demand will prevent a further fall in sales.
- A large part of domestic sales is driven by replacement demand. The typical holding period for a tractor is 6-9 years, with most of the tractors being replaced in the country within 7-8 years. 50-60% of overall domestic demand constitutes replacement demand. In states having a high penetration of tractors, such as Punjab and Haryana, the replacement demand accounts for 70-80% of total sales. On the other hand, states where farmer incomes are lower compared with Punjab and Haryana have a lower replacement cycle (higher age tractors) vs industry average.

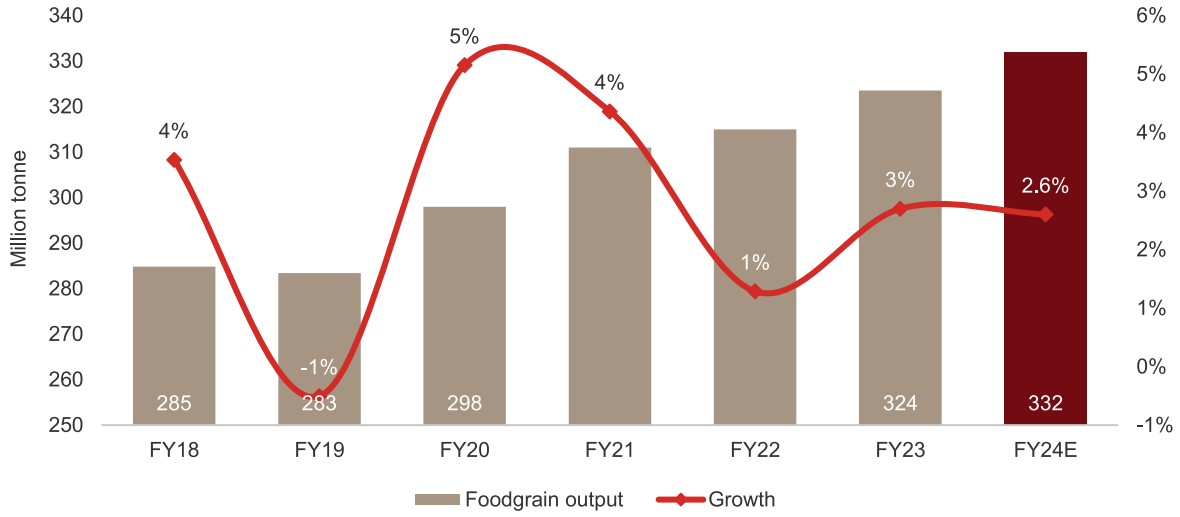
- This fiscal, replacement demand is expected to be higher (4-6% on-year) with healthy sales registered in fiscals 2017 and 2018. CRISIL MI&A estimates replacement demand to have been higher by 0-2% in fiscal 2023 on account of demand deferment amid positive farmer sentiment in the fiscal. However, lower sales recorded in fiscals 2015 and 2016 prevented further growth in replacement sales in fiscal 2023.
- Commercial demand for tractors accounts for 18-23% of overall tractor demand. Apart from their primary application in agricultural operations, tractors are used to haul bricks, sand, and farm produce. In poor crop years and in months when there is no agricultural activity, renting out tractors for commercial purposes provides farmers an alternative source of income, thereby proving to be a good hedge. Some tractors are designed specifically for haulage operations and are used exclusively in commercial activities. Based on our industry interactions, tractors are also used as an alternative to pickups for haulage purposes.
- This fiscal, CRISIL MI&A expects commercial demand to rise due to an anticipated increase in construction and sandmining activities. In fiscal 2023, due to slower retail momentum in eastern states and a complete ban on sandmining activities, commercial demand remained range bound. Illegal mining activities have been at a standstill in states such as Bihar, Jharkhand and Uttar Pradesh, negatively impacting commercial demand in the last two fiscals.

Improving farm income and pick-up in commercial activity to drive domestic tractor demand

Parameters	Impact			
	FY21	FY22	FY23	FY24E
Farm income	**F**	**N**	**F**	**N**
Crop prices (minimum support price or MSP)	F	N	F	N
Crop output	F	N	F	N
Kharif output	F	N	F	N
Rabi output	F	N	F	N
Demand indicators	**NF**	**N**	**N**	**N**
Infrastructure development	NF	N	F	F
Sand mining	N	N	N	N
Finance	**N**	**N**	**N**	**F**
Agri credit, finance availability	N	N	N	F
Supply	**F**	**NF**	**NF**	**N**
Channel inventory	F	NF	NF	N
Player action: Pricing and products	F	F	N	N

Source: CRISIL MI&A

Foodgrain target higher on-year for fiscal 2024



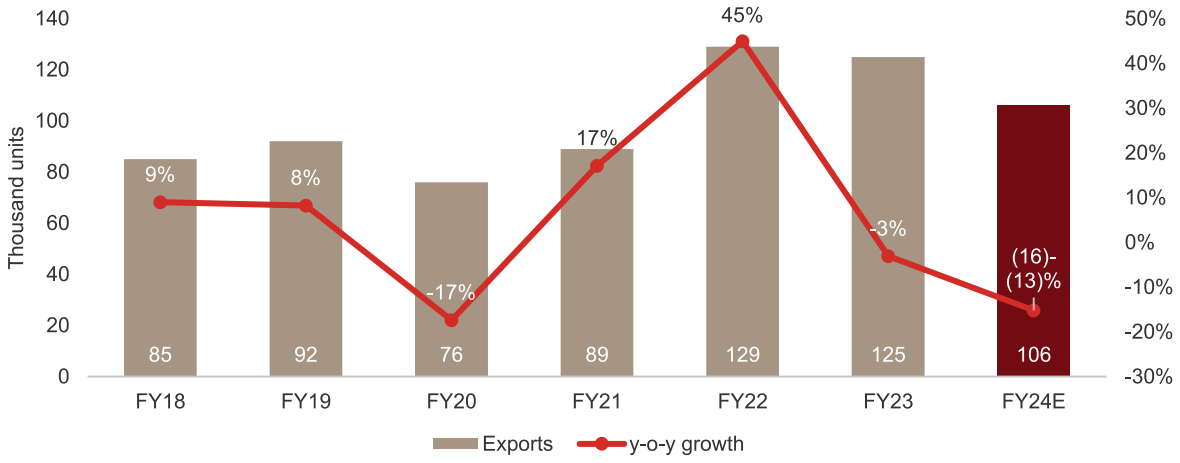
E: Estimated
Source: Ministry of Agriculture, CRISIL MI&A

The government has set the foodgrain production target at a record level of 332 million tonne for the 2023-24 crop year. The target is 2.6% higher compared with the previous year's output.

Domestic demand to grow 3-5% over next five years on a high base

- CRISIL MI&A projects domestic tractor sales to expand at 3-5% compound annual growth rate (CAGR) during fiscals 2023 to 2028, after factoring in one to two years of erratic monsoon during the period along with healthy sales expected in the remaining years. From fiscal 2018 to 2023, the industry registered a CAGR of 5% due to healthy sales in fiscals 2017, 2018, 2021 and 2023.
- Tractors is a cyclical industry and has been observed that whenever the industry gets into a downturn, it takes 4-5 quarters for the industry to recover. Thus, assuming that the industry will be impacted by poor monsoon for one to two years between fiscal 2024 and 2028 with the industry taking 4-5 quarters to recover, our long-term assessment suggests that the tractor industry will grow at a CAGR of 3-5%. The growth will be supported by low tractor penetration in India (3 tractors per 100-hectare area); government's focus on improving farm incomes through various schemes, promoting farm mechanization; and investments to improve rural infrastructure.

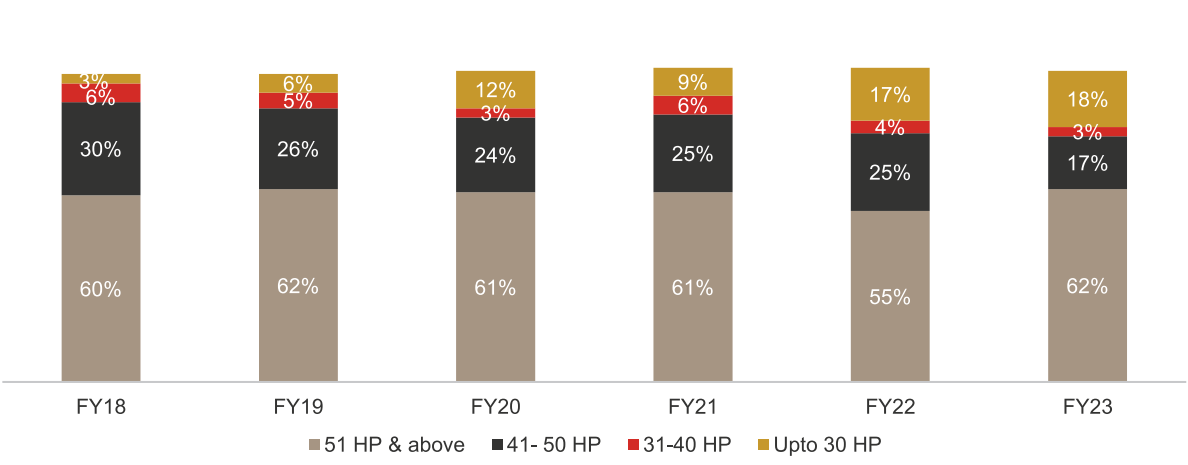
Tractor exports to contract 13-16% this fiscal due to global economic slowdown



E: Estimated
Source: TMA, CRISIL MI&A

- Exports, accounting for about 12% of overall tractor sales in fiscal 2023, are expected to decline 13-15% on-year this fiscal. Slowdown in various Asian and European countries, coupled with subdued demand from the US, is expected to impact exports during the fiscal. CRISIL MI&A expects some revival in demand from Europe; however, with demand from Asia and the US anticipated to remain weak, overall tractor exports are expected to remain sluggish this fiscal.
- In fiscal 2023, tractor exports declined 3% on-year on a high base (45% on-year growth) of the preceding fiscal. Demand for Indian tractors had been weaker in various Asian and European countries due to political disruptions and energy crises in these regions.
- Strategic push, such as setting up a base in foreign countries, by players to cater to the global demand would drive export sales. ITL's Solis brand has also been gaining popularity in the European markets. With most of the global companies de-risking exports from China due to the complexities and disruptions in the nation, India has become the natural hedge against Chinese exports.

Tractors Up to 30HP on an uptrend in exports

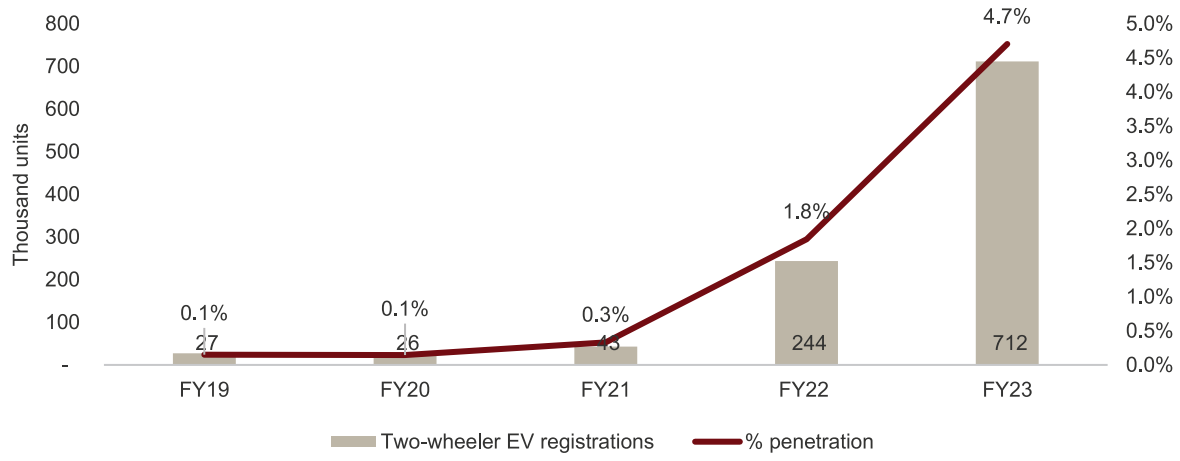


Source: TMA, CRISIL MI&A

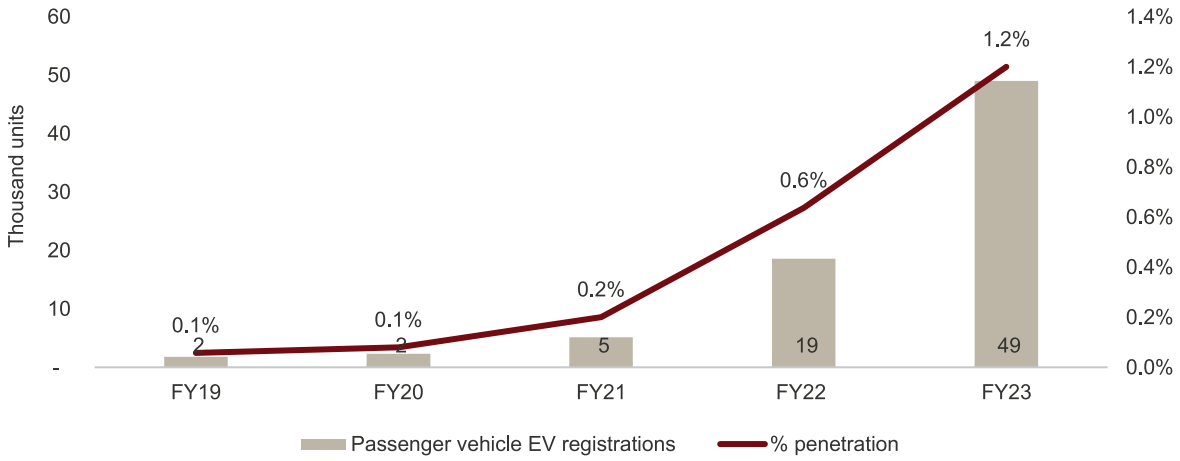
7 Electric vehicles domestic sales

Overview of the domestic electric vehicle (EV) market in India

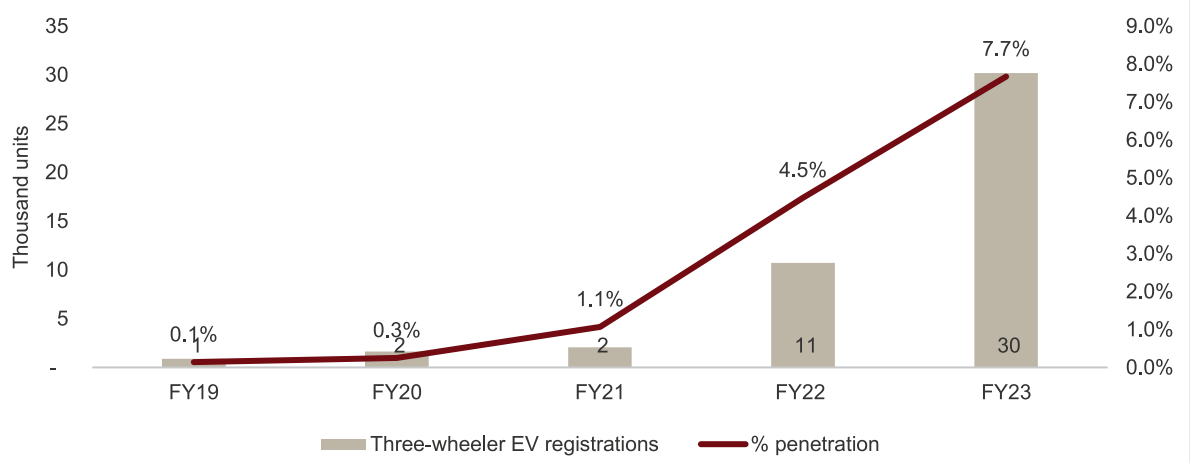
Two-wheelers



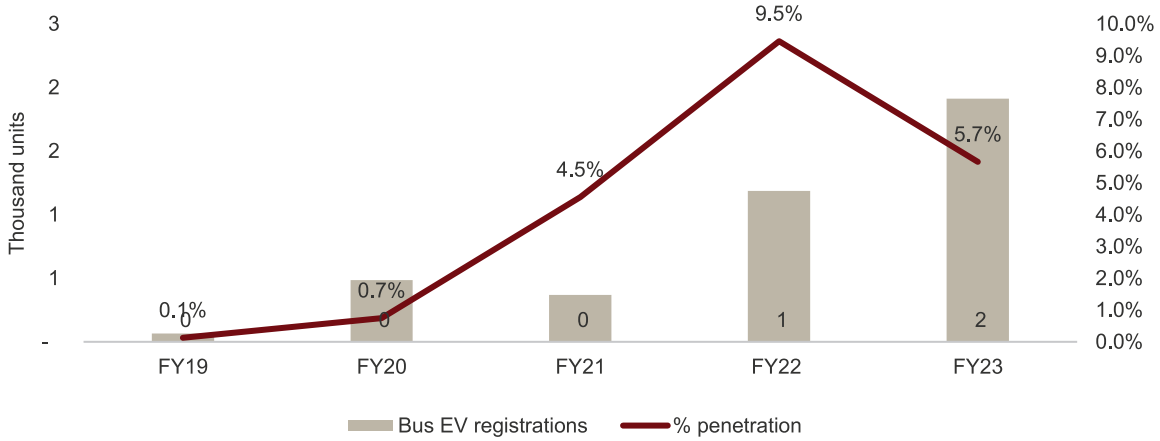
Passenger vehicles



Three-wheelers



Buses



Notes:

1. *Figures exclude Telangana*
2. *Registrations include figures only for high-speed vehicles (>25 kmph)*
3. *Three-wheelers do not include e-rickshaws*

Source: MoRTH, CRISIL MI&A

To curb pollution, electric vehicles are gaining global interest. India is also a signatory to the Paris Agreement under the United Nations Framework Convention on Climate Change. The country is also part of the EV30@30 campaign, targeting a 30% sales share for EVs by 2030.

The government is extending support via FAME and tax-rate cuts to boost EV adoption. Furthermore, growing awareness, concern for environmental issues, and increasing focus from automotive companies are driving electrification in India.

The EV segment received a real thrust in the last two years with model launches, increasing awareness, elevated fuel prices, and improvement in infrastructure support.

The government announced Rs 100 billion for Phase II of FAME, which commenced on April 1, 2019. The policy aims to provide a subsidy of Rs 10,000 per kWh to four-wheelers (battery electric vehicles, plug-in hybrid electric vehicles, strong hybrids) for commercial purposes and public transport. It envisions creation of infrastructure for charging of EVs. The subsidy for two-wheelers is Rs 15,000 per kWh, although it was reduced from June 2023 by lowering the cap on maximum subsidy from 40% of vehicle ex showroom cost to 15%.

EV adoption has been relatively fast in the two- and three-wheeler segments. A sharp rise in fuel costs in the last two years provided an added incentive to the price-sensitive customers of two- and three-wheelers. Moreover, a bevy of vehicle launches from the industry backed the adoption growth, especially in fiscal 2023.

EV adoption in two- and three-wheelers shot up from 1.8% and 4.5% in fiscal 2022 to 4.5% and 7.7%, respectively, in fiscal 2023.

Due to the government's support through FAME and focus on quicker adoption of EVs in public transport, there has been a significant increase in electric bus sales in the last couple of years. In fiscal 2023, EV penetration in the bus segment reached 5.7%. For buses, the penetration level came down in fiscal 2023 due to a sharp rise in Internal combustion Engine ICE bus sales during the year. However, in terms of volumes, EV bus sales witnessed growth during the year.

The EV subsegment in the passenger vehicle category is quite nascent (1.2% as of fiscal 2023) amid the range anxiety, limited charging infrastructure availability, and relatively high costs of EVs, making the total cost of ownership higher than its counterparts. However, EV sales are witnessing healthy on-year growth, backed by rising awareness, shifting consumer preference, new vehicle launches at competitive pricing (EV launches in the hatchback segment as well), and expanding charging infrastructure.

Outlook for EVs in India

Two-wheelers

CRISIL MI&A expects e-2W market penetration to be 5-7% in fiscal 2024, restricted by the cut-down in FAME subsidy during May 2023. After a sharp dip in EV retails during June 2023, CRISIL MI&A expects gradual improvement going forward, backed by a plethora of price-competitive launches and gradual acceptance of increased prices by customers.

EV penetration is expected to reach above 30% by fiscal 2030, driven by urban scooter buyers. The adoption will be led by the expanding portfolio of EVs, improving EV infrastructure, and rising awareness.

Passenger vehicles

From a low base of fiscal 2023, CRISIL MI&A expects EV penetration in the PV industry to rise to 3-4% in fiscal 2024 and reach 17-23% by fiscal 2030. A healthy pipeline of EV launches by OEMs will provide the thrust to EV adoption in PVs.

This expansion in adoption will be spearheaded by the taxi/commercial passenger vehicle segment. For this segment, the continued lower cost of ownership will provide the incentive to shift from ICE vehicles to EVs. Moreover, the entry of greentech EV-only start-ups such as BluSmart and CAB-E will further boost demand. EV adoption in the personal segment is expected to be gradual.

EV penetration will also be propelled by policies adopted by the government for penalising non-adherence to CAFE norms.

Three-wheelers

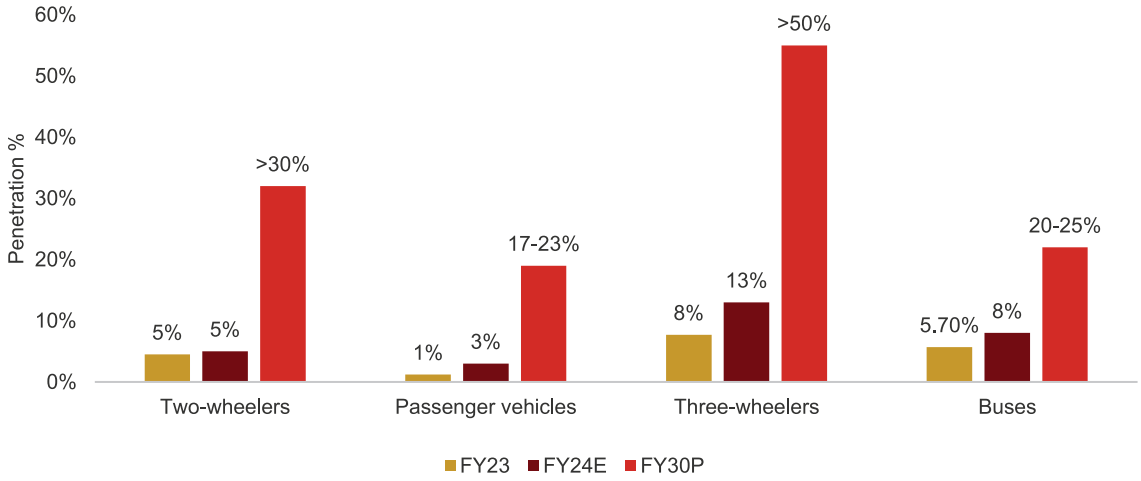
CRISIL MI&A expects EV penetration in the three-wheeler segment to be 12-15% in fiscal 2024 and reach above 50% by fiscal 2030. Penetration in fiscal 2023 was ~8%. Three-wheelers will spearhead the Indian EV journey because these vehicles are often used for short-distance trips, carry more load, and generally make do with a day's worth of charge. In addition to the cost advantage due to central and state subsidies on EVs, the total cost of ownership of an electric three-wheeler is much less than that of an ICE alternative.

Moreover, all the conventional large OEMs including Bajaj, Piaggio, Mahindra, and TVS have launched E autos in the Indian market, and their supply has been improving. This is expected to provide a boost to EV adoption in the long term.

Buses

CRISIL MI&A expects EV penetration in buses to be 7-9% in fiscal 2024 and reach 20-25% by fiscal 2030, driven by state transport undertakings (STUs). Penetration in fiscal 2023 was 5.7%. Operational profiles of buses with fixed routes and regular stops make them suitable for charging at pre-determined intervals and specific locations. With other incentives from the central and state governments, the sales of electric buses are expected to pick up in the long term.

Segment-wise electrification



Source: CRISIL MI&A

Contributors:



Hemal Thakkar
Director



Anviksha Patel
Manager



Vishal Gori
Manager



Makarand Pathak
Senior Consultant

About CRISIL Market Intelligence & Analytics

CRISIL Market Intelligence & Analytics, a division of CRISIL, provides independent research, consulting, risk solutions, and data & analytics. Our informed insights and opinions on the economy, industry, capital markets and companies drive impactful decisions for clients across diverse sectors and geographies.

Our strong benchmarking capabilities, granular grasp of sectors, proprietary analytical frameworks and risk management solutions backed by deep understanding of technology integration, make us the partner of choice for public & private organisations, multi-lateral agencies, investors and governments for over three decades.

About CRISIL Limited

CRISIL is a leading, agile and innovative global analytics company driven by its mission of making markets function better.

It is India's foremost provider of ratings, data, research, analytics and solutions with a strong track record of growth, culture of innovation, and global footprint.

It has delivered independent opinions, actionable insights, and efficient solutions to over 100,000 customers through businesses that operate from India, the US, the UK, Argentina, Poland, China, Hong Kong, UAE and Singapore.

It is majority owned by S&P Global Inc, a leading provider of transparent and independent ratings, benchmarks, analytics and data to the capital and commodity markets worldwide.

For more information, visit www.crisil.com

Connect with us: LINKEDIN | TWITTER | YOUTUBE | FACEBOOK | INSTAGRAM

CRISIL Privacy Notice

CRISIL respects your privacy. We may use your personal information, such as your name, location, contact number and email id to fulfil your request, service your account and to provide you with additional information from CRISIL. For further information on CRISIL's privacy policy please visit www.crisil.com/privacy.

Argentina | Australia | China | Hong Kong | **India** | Japan | Poland | Singapore | Switzerland | UAE | UK | USA
CRISIL Limited: CRISIL House, Central Avenue, Hiranandani Business Park, Powai, Mumbai – 400076. India
Phone: + 91 22 3342 3000 | Fax: + 91 22 3342 3001 | www.crisil.com
/company/crisil @CRISILLimited /CRISILLimited /user/CRISILLimited /lifeatcrisil
CRISIL An S&P Global Company

Hydrogen Roadmap & Flexibility - Transforming Indian Automotive Industry in Sustainable Era

by

RACE in India

eninrac

2023 ACMA Report

Hydrogen Roadmap & Flexibility - Transforming Indian Automotive Industry in Sustainable Era

Evaluating & understanding the potential role of hydrogen in Indian economy with transport focus and relevant use cases with global frameworks for commercialization



www.eninrac.com

powered by why

I. Introduction

3 Message from our Managing Director
5 About Eninrac
6 Eninrac's Client Capabilities
7 Eninrac's Products & Services

II. Background

9 Background & Introduction to Research
16 Indian H2 Economy & Transport Model
18 Market Sounding & Opportunity

III. Piloting, MCA & FCT

20 Market for H_2 transport technology
23 Successful piloting
24 Multi-criteria analysis & role comparison of FCEVs & BEVs
26 FCT & FCEV applications
29 TCO & user choice evaluation

IV. Global Developments

31 Private transport & Piloting
32 Public transport & Piloting

V. Opportunities

37 Opportunities for assessed hypothetical projects
51 Integrated Outcomes

VI. Learnings

55 Learnings for India from global markets for adaptability of hydrogen fuel cells vehicles
62 Procurement Models – Enhanced Outcomes, Capturing Global Experience

VII. Way Forward

71 **Conclusion & recommendations – Way forward**

VIII. Connect With Us

Message from our managing director

Sustainability has transformed into a strategic priority for India & hydrogen shall hold the key



Ravi (standing) addressing Japanese delegation from JXTG Nippon on clean mobility opportunities in India with colleagues in New Delhi, India

Sustainability – Strategic priority for India

Globally the focus on concerns on climate change and environmental degradation has been getting slowly but surely transforming into strategic priority for different countries. In India too, Government's at concurrent levels along with the investors are now pushing automotive organizations to change their ways of working, culture and products. Certainly, this shall have a far-reaching implications for the automotive industry in India, that while making substantial progress still requires to set up its **sustainability efforts with pre-defined milestones.**

Our research aimed to evaluate the automotive industry's research through exclusive "voice of customer" (VoC) surveys response to the challenge of sustainability and the role potentially hydrogen is slated to play. Significantly the key finding which evolves is that implementation of sustainability initiatives in the country which remains fragmented and lacks on multiple fronts. Some key areas such as focus upon sustainable R&D and sustainable manufacturing for automotive OEMs which should be revolving around industry's core competencies is inconsistent. Ironically, India lacks the consistent focus upon the sustainability initiatives across the industry.

For road transport in India hydrogen support would hold key for BEVs and FCEVs sales

For India to enable a fast and sustainable green transformation in the road transport sector is challenging and as still the country is heavily reliant on fossil fuels. It shall be difficult to cater to the challenge without apt contributions from hydrogen evolving as a suitable alternative. We expect, that zero emission vehicles will se a mix of battery electric vehicles and fuel cells (using hydrogen). Although, BEVs are becoming more common and offer multiple use cases in transport sector from which India can greatly benefit but hydrogen can be a real game-changer.

Hydrogen, however, holds some critical advantages to make it more apt under certain scenarios. For a country like India where renewable penetration has been significant it shall make sense to use hydrogen for both electricity generation and transport as well. **Additionally, hydrogen is well positioned for wherever large amounts of energy are needed for the vehicle performance due to higher energy storage density of fuel cell systems**. This is why we anticipate hydrogen to play a key role in both passenger vehicles and at a large scale for commercial vehicles.

But there would be challenges for the introduction of FCEVs in India which need to be overcome if hydrogen must realize its potential as a sustainable fuel for road transport. It is pertinent to note that hydrogen would be effective if it's produced from "low carbon"; the environmental credentials of hydrogen depend on its production methods and there is currently now widespread hydrogen distribution and refueling infrastructure.

Consumer choice & need understanding for growth of hydrogen in transport shall be pivotal in India

2020 evolved a landmark year for alternative fuel cars in India, as growth in number of the passenger vehicles were observed in bigger cities. This focus on alternative fuel cars will go on a rise and is anticipated to reach higher levels by 2030. With alternatives ranging from ethanol blending, battery power vehicles & hydrogen in the play as well the society's transport demands and preferences need to be well understood by OEMs and value chain players. The key factors which would be necessary to be included for future studies are:

- **Widespread availability** of ultra-low emission vehicle
- **Growth in e-commerce and** reduced commuting (accelerated by COVID-19)
- Accessibility and increase **in car-share behaviour** or fleet transport
- Accessibility and growth of **'Micromobility' & 'Large-mobility'** (use of vehicles such as 2W, 4W, LCVs, MCVs and HCVs)
- Greater uptake of hydrogen vehicles in public transport
- Uptake in material handling equipment
- Mine haulage equipment
- Government enabled & last mile logistics
- Road freight corridors development

Our firm's purpose is to help enable authenticity in market research and bring right signals from the stakeholders and showcase the on-ground challenges as-is for qualified business decisions. Through out this report we have tried to capture the role of hydrogen in enabling a sustainable transport infrastructure in India and key learnings across the globe which can be potentially adapted. For us, its about ford through one milestone to another.

Ravi Shekhar Managing Director & Research Head, Eninrac Consulting

Learn more about eninrac:
Watch video for specific inputs



About Eninrac

Established in 2013, Eninrac has been dedicated to propelling businesses forward by crafting innovative solutions that seamlessly connect them with a realm of opportunities. Our knowledge services combine domain knowledge, market insights & outlook which enable clients with an exclusive "difference margin" and empower them to make confident business decisions backed by authoritative intelligence. Our core belief is that every company, regardless of its scale, should experience the exhilaration of growth.

Elevate Your Organization's Efficiency with Our Expertise

Eninrac redefines capability. With a wealth of experience and a commitment to excellence, we fuse domain expertise, market insights, and forward-thinking to empower growth. From sharp questioning to holistic solutions, we transcend boundaries, propelling innovation across functions and sectors. **Eninrac: Architects of Transformation.**

Resolving Challenges, Amplifying Advantages

Eninrac excels at transformative problem-solving. With strategic insight and innovative consulting, we convert challenges into distinct advantages. Partner with us to cultivate a 'difference margin' that propels your success in a competitive landscape.

Understanding consumers with flawless market research

Eninrac excels in deciphering consumer behavior through impeccable market research. Our seasoned experts delve deep into market dynamics, unveiling invaluable insights that guide strategic decisions. With a focus on precision and comprehensive analysis, we illuminate the path to informed business choices, ensuring your organization stays ahead in a rapidly evolving landscape.

Powered by Why!

Our services drive clients ahead with a unique 'difference margin,' excelling in perceptive questioning, generating profound insights, crafting holistic solutions, and enhancing value. Our hallmark is rooted in distinct cross-functional expertise, while focusing on clients' future growth.

95%+
of client retainership maintained

1047+
custom market research delivered

395+
group companies benefitted by the action automatically triggered for companies in 2022

15+
industry verticals proven service track for clients under 7 major global regions

EXCLUSIVE PARTNER
of Statista GmBH for data solution

FIVE MINUTES
to book a custom research service



Our Client Capabilities

There is simply no substitute for dedicated effort, and embracing the ethos of treating our clients' concerns as if they were our own has garnered us remarkable commendation. Perhaps the most gratifying aspect for our team is the endorsements we have received, which stand as a testament to our commitment. These endorsements serve as a driving force, continually inspiring us to maintain our vigilance and deliver our utmost best. At eninrac we aim to utilize our valuable years of direct, front-line experience as well as deep industry insights to ensure our clients' success.

How have we offered services to our patrons so far?

Research Reports

Crafted through a fusion of domain expertise, market insights, and forward-looking perspectives, our research reports are designed to empower client's business. With a team of top-tier professionals and extensive industry acumen, we breathe life into novel concepts and emerging ideas, providing you with groundbreaking insights that set new industry standards. **Close to 3/4th of our clients rely upon sector specific research reports.**

Advisory & Consulting Services

Advisory and consulting services provide clients an exclusive "difference margin", granting a competitive edge. Recognizing and capitalizing on market shifts is vital for global growth across industries. Eninrac's services enhance operational efficiency, tap growth potential, and offer practical solutions, ultimately minimizing costs and fostering business expansion. **We have supported 60% of our clients through our long-term engagements of Advisory & Consulting Services (ACS).**

Custom Research Solutions

Our experienced advisors and consultants center their efforts on addressing client's paramount business challenges and capitalizing on opportunities, guiding your enterprise through transformative shifts. By shaping innovative organizational paradigms and aligning strategies, we empower client's business to thrive amidst change. **This is one of the most popular service offering which is being leveraged by 2/3rd of our clients.**

Business Intelligence

Business Intelligence Services (BI) software processes business data into user-friendly formats like reports, dashboards, charts, and graphs. Eninrac's BI Services enable organizations to embrace flexibility and perpetual evolution, comprehending essential business challenges. That's why we offer business intelligence services through which tenable innovations are offered for faster & efficient deployment of solutions. **We furnish market insights, data analysis, and strategic counsel, empowering informed decisions and fostering sustainable growth.**

Why Us?

Our services enable the clients to lead the competition with a defined "difference margin" which is unique in its way as it aims at right questions, generates better business insights, culminates into integrated solutions and facilitates value multipliers with ease. We bring deep cross functional expertise but are identified through our unique perspectives as we focus on future of client's business by capturing values across both lateral and vertical boundaries, silos and periphery of the organization.



Our Products & Services

Our commitment to simplifying complexity remains steadfast and unchanging. Passion is woven into every endeavor we undertake, fostering deep collaboration with clients and colleagues through cross-pollination. This approach grants us a unique ability to generate perspectives that stand out. Our ethical standards are resolute – we pursue nothing less than par excellence in all our products and services. This passion coexists with honesty; we readily admit our mistakes and embrace opportunities to learn and grow. Fueled by high aspirations and an unwavering desire to excel, we approach our work with an owner's mindset.

Our collaborations extend across private, public, and non-profit sectors, spanning the value chain, aimed at outperforming the competition. We engage closely with clients to dissect business challenges, offering efficient solutions that drive lasting transformation.

omnicore+ by eninrac

OMNICORE is our dedicated portal created to felicitate clients with firsthand updates across energy & infrastructure sector with unique blend of perspective, analytics carved specifically for insdustry leaders & CXOs

Learn more about Omnicore

vantedge+ by eninrac

Vantedge are powered by unique thought process and proprietary insights, this unit blends our industry first research with practice specific analytical models for critical business decisions on market entry, strategy, profitable investments, and enhanced performance.

Learn more about Vantedge

MRAC+

At we aim to utilize our valuable years of direct, front-line experience as well as deep industry insight to ensure our client's success through our specific services in order to edge past their competition and thrive in their respective business segment.

Learn more about MRAC

ER eninrac reports

"Well Examined" inputs combine together with unique thought process of our consultants and analysts for different industry practices to take shape of report with equal and meticulous efforts yet keeping timeline constrain intact. "edge"

Learn more about Research Reports

vb vision board

How can business of all sizes leverage the vision board to gain best market insights? The answer is using eninrac's exclusive Vision Boards.

Insights & productivity tools for all your make vision needs

Learn more about Vision Boards

Background & introduction to research

In this chapter, we share the purpose for sustainability in transport sector for India and the potential role hydrogen is slated to play. Possible framework design with current staggered framework in view which can cater to market sounding of opportunities in the automotive space.



In this chapter

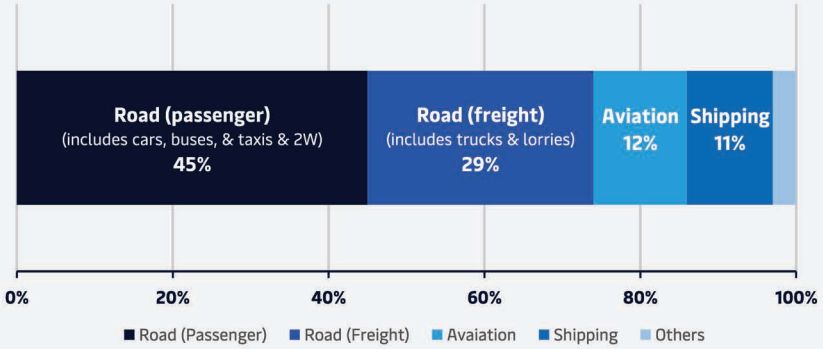
10 Purpose
11 Strategic priority - Sustainability
15 Framework & Implementation
16 H_2 for transport
18 Market sounding

Background & introduction to research

From the beginning of 2000's the automotive industry across the globe has been under tremendous pressure from both the governments and society to pursue more sustainable model for growth. It's been slower but prevalent in India as well as the country has been gradually absorbing the penetration of EVs. The response from the automotive sector in the country in this regards has been phenomenal with all major OEMs planning to launch EVs or have already launched one. However, the transition signals some severe environmental issues as well:

- Transportation accounted for nearly 25% of global carbon emissions with road transportation accounting for close to 20%
- China being the central supplier of EV value chain globally mines most of the graphite used in EVs which is completely non-regulated and is leading large scale environmental damages
- The EVs production consume many critical minerals which are not readily available in India and is completely import dependent

Exhibit: Global CO_2 emissions from transport



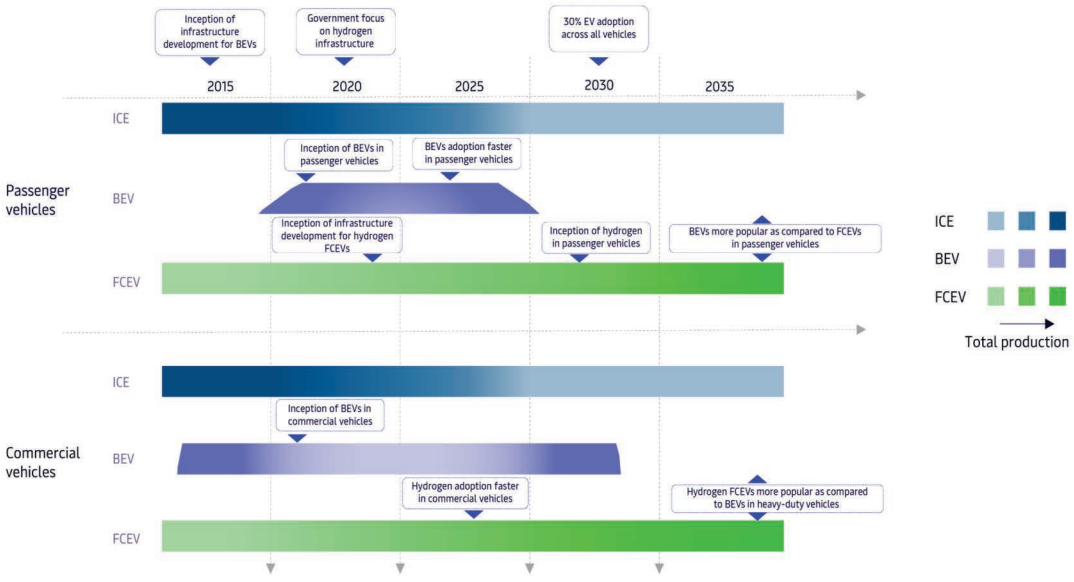
Source: IEA, eninrac research

Purpose – Sustainability & hydrogen role

While sustainability has been on the agenda for automotive OEMs for some time now in India, today we can safely say it has achieved new urgency and importance. Given the constraints faced up by BEVs w.r.t imports the chances for growth of FCEVs improves as it provides for credible alternative and support from GoI through "Atamnirbhar" initiative. Steps taken by the Government and industry combined will enable the sustainable transition for transport sector in the country.

The FCEVs in a fast-evolving mobility space may lead to some uncertainties for OEMs especially while focusing India as a market. Co-existence with various technologies would be a clear way forward for the country. One of the possible strategy is to introduce FCEVs for buses, trucks, and other heavy-duty vehicles while BEVs may remain exclusive to the passenger cars paving way for faster hydrogen adaption.

Exhibit: Likely Timelines for different vehicle types across different use cases

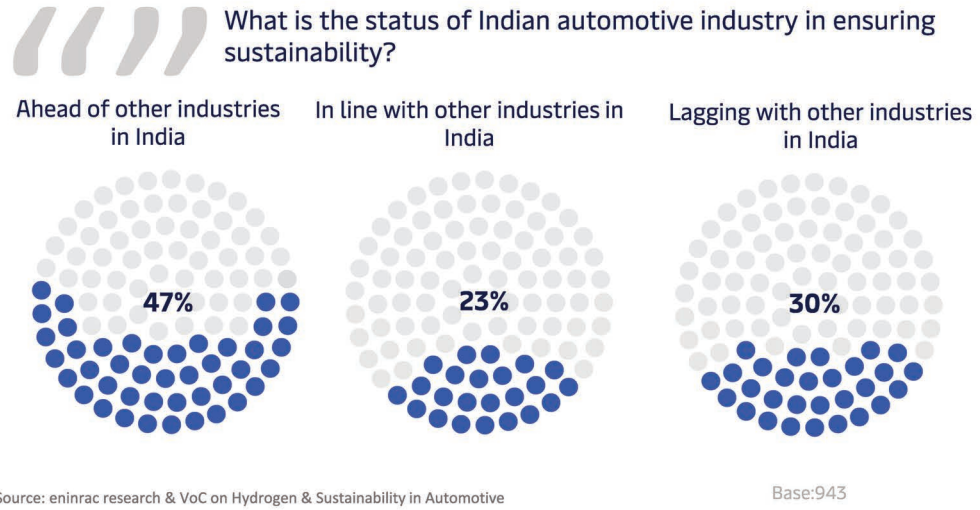


Source: eninrac research & Arthur Little

Sustainability – Strategic priority for India

We conducted a sector based "voice of customer" (VoC) for understanding the sustainability perspective for the automotive industry of India along with the potential role which hydrogen can play under both passenger and heavy vehicles sector. The general perspective is reaffirmed focus upon sustainability aspects by almost all domestic and international OEMs. Sustainability is a long-range plan for the companies not only under their subsequent operations but also to work with the supply chain network to transform the entire value chain sustainable. Furthermore, sustainability now plays a key role in the investors and board priorities. The VoC revealed that for India the key drivers for automotive sector's sustainability would be zoned around compliance to be at global level and responsible organization and focused R&D to meet customer expectations around sustainability for both new and existing product lines.

Exhibit: VoC survey responses on progress of automotive industry in India w.r.t sustainability initiatives



Source: eninrac research & VoC on Hydrogen & Sustainability in Automotive

Base:943

Automotive industry & sector experts are aligned on sustainability priorities for the country

With industry united behind sustainability as a strategic priority in India, our VoC also found broad alignment on the priorities that will have most significant impact on driving results and progress in the country. We conducted the survey at a base of over 900 industry experts and executives for understanding the priorities.

The top initiatives which lie common to both the experts and executives wherein both seem aligned in the results of VoC were – **a.** supporting a circular economy for India **b.** sustainable R&D and product development **c.** promote sustainable manufacturing & **d.** recycling of waste and easy returns for end-of-life disposal

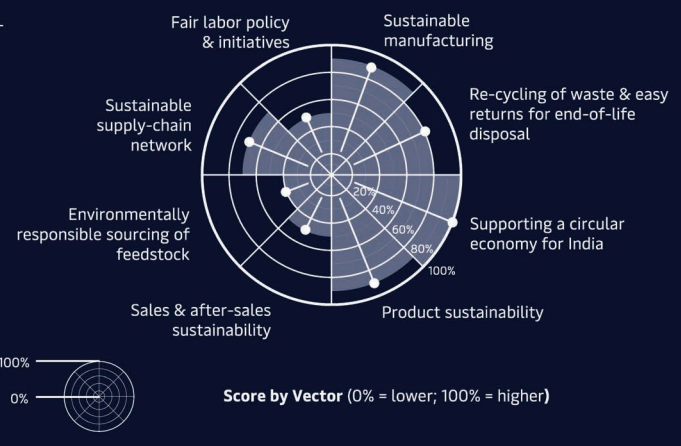
Most of our plants are partially meeting their electricity consumption needs through renewable energy. Further, to reduce the carbon footprints in manufacturing we are exploring the application of green hydrogen as well to be sustainable in our product manufacturing. Also, we are working on a multi-product strategy to cater to the consumer choices and meet industry expectations for sustainability

Head of Sustainability, Marelli India

Exhibit: Priorities ranked as per inputs in VoC for automotive industry expert

- Factor 1: **Sustainable** manufacturing – 90% agree
- Factor 2: **Re-cycling of** waste – 82% agree
- Factor 3: **Supporting circular** economy – 100% agree
- Factor 4: **Product** sustainability – 85% agree
- Factor 5: **Fair labor** policy – 50% agree
- Factor 6: **Sustainable** supply chain– 65% agree
- Factor 7: **Environmentally** responsible – 35% agree
- Factor 8: 5**After-sales** sustainability – 45% agree

Base:943



Score by Vector (0% = lower; 100% = higher)

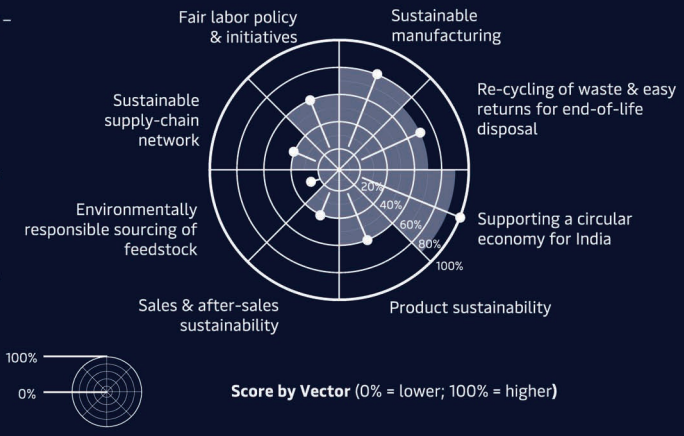
For us, hydrogen was the most viable source of sustainable fuel, based on our requirements for medium-to-long-haul and heavy-payload capable light vans. Renewable energy is a key focus for us, as our delivery fleet represents our largest individual source of emissions."

Head of Products, Commercial UK

Exhibit: Priorities ranked as per inputs in VoC for automotive executive priorities

- Factor 1: **Sustainable** manufacturing – 80% agree
- Factor 2: **Re-cycling of** waste – 67% agree
- Factor 3: **Supporting circular** economy – 90% agree
- Factor 4: **Product** sustainability – 60% agree
- Factor 5: **Fair labor** policy – 55% agree
- Factor 6: **Sustainable** supply chain– 43% agree
- Factor 7: **Environmentally** responsible – 22% agree
- Factor 8: **After-sales** sustainability – 36% agree

Base:943

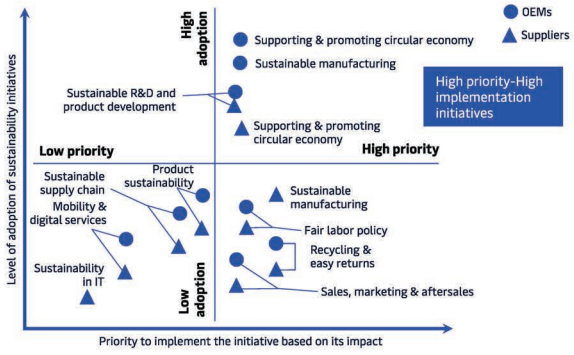


Score by Vector (0% = lower; 100% = higher)

Fragmented implementation of sustainability

For sustainability to meet the ambitious goals of the industry, it needs to be pursued over the automotive value chain network. The VoC conducted by eninrac found that nearly 58% of automotive organizations claimed to have developed a comprehensive sustainability with well-defined goals and targets. In the exhibit below we compared the level of adoption of sustainability initiatives against their priorities indicated by experts. The top-right quadrant is the sweet spot – where OEMS and suppliers are implementing initiatives that have the most impact. We found that OEMs outperformed suppliers in all apart from three initiatives.

Exhibit: Suppliers lag OEMs in adopting sustainability initiatives



Source: eninrac research & Channel checks

Table: Highest & lowest adoption of sustainability initiatives – By country and deployment levels

Sustainability Initiative mandated & deployed	Highest adoption		Lowest adoption	
	Country	Deployment	Country	Deployment
Circular economy promotion	Germany	67%	India	22%
Sustainable R&D	France	56%	China	37%
Sustainable manufacturing	Germany	55%	France	31%
Product sustainability	France	38%	India	26%
Supply-chain sustainability	USA	37%	France	23%
Recycling of waste	USA	35%	UK	13%
Sustainable power procurement	Germany	31%	India	15%
Fair labor policy	USA	30%	UK	6%
Environmentally responsible sourcing	Sweden	30%	France	8%
Sales & after sales sustainability	USA	28%	UK	13%
Mobility & digital services	Germany	23%	UK	3%
Sustainability in IT	Sweden	22%	UK	13%
Due diligence of all material & product	India	15%	Sweden	4%

Source: eninrac research & Channel checks

Sustainability in automotive industry – maturity framework for India

The questions which remains as an imperative is how can automotive firms in India attain a sustainability strategy and deliver to its goals. To do this, we assessed the maturity of automotive organizations' sustainability programs against four areas:

- Vision for Sustainability
- Engagement for Sustainability
- Governance for Sustainability
- Iterative roadmap

Sustainability framework for automotive industry in India

- **Vision for Sustainability** - the long-term ambition on sustainable action, declared strategy, goals, and an assessment of risks, exposures and opportunities related to climate change
- **Engagement for Sustainability** - partnering within and outside the automotive value chain on mitigating environmental impact and communicating it effectively to all stakeholders
- **Governance for Sustainability** - how sustainability is managed, including the specific responsibilities of executives at different levels for delivering the organization-wide vision
- **Iterative roadmap** - operational activities involving other value chain partners. For example, to implement and drive to completion new business models, mobility and digital services, and circular economy initiatives

We scored the responses of automotive organizations that we surveyed based on the elements of the above framework. Organizations who do better than the average across all four pillars are classified as sustainability leaders. Those that perform below average on at least three of the four pillars are classified as laggards. The remaining population in between forms the majority cohort.

Exhibit: Sustainability maturity framework for automotive industry in India



Source: eninrac research & Channel checks

Indian H_2 economy & transport model

The size of the opportunity for Hydrogen for Transport relates to the size of the existing transport market and the size and value of existing vehicle fleets. As the exhibit illustrates, when considering all modes, India has approximately US$ 280 Billion transport industry including road freight and revenue from transport services. This presents significant scope for technological application.

Value: Largest mode types of the transport sector

Passenger vehicles are the dominant component for India's transport industry, particularly from a wholesale revenue perspective where more than a 3 to 4 million vehicles are sold in the country every year. The sales of SUVs and utility vehicles have gone up in past 3-4 years and are amongst highest in vehicle sales.

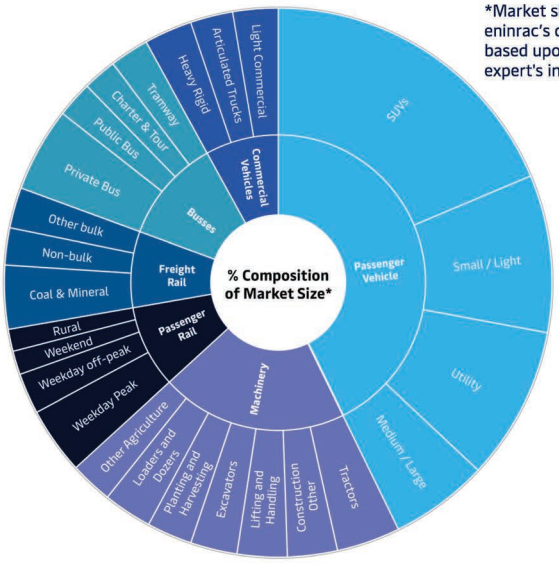
Machinery also forms a significant market segment from wholesale perspective. Applications of this equipment are varied but relate to India's primary industries such as mining and agriculture, and downstream activities such as logistics and construction.

Emissions: Most carbon-intensive modes of transport sector

When considering the market in terms of emissions, transport accounted for around 23% of man-made greenhouse gas emissions globally in 2010 and has continued to increase since then, according to a report to the Intergovernmental Panel on Climate Change. India's transport emissions are in line with the global proportion, projected to be responsible for around 25% of all Indian emissions in 2022.

The road-based transport modes make 75% of Indian transport emissions. Private passenger vehicles are the single largest mode in terms of their emissions contribution. Commercial vehicles are also significant greenhouse gas producers relative to the size of the Indian fleet. This composition highlights the opportunities that exist within the private, freight and commercial sectors to apply hydrogen technology and mitigate greenhouse gas emissions. While hydrogen as a fuel has a carbon intensity dependent on its manufacturing process, it is possible to produce low-emission hydrogen through electrolysis from renewable electricity. Currently, only 2% of global hydrogen production is produced by electrolysis. The other 98% of hydrogen is produced from fossil fuels, through methods such as steam methane reforming and coal gasification

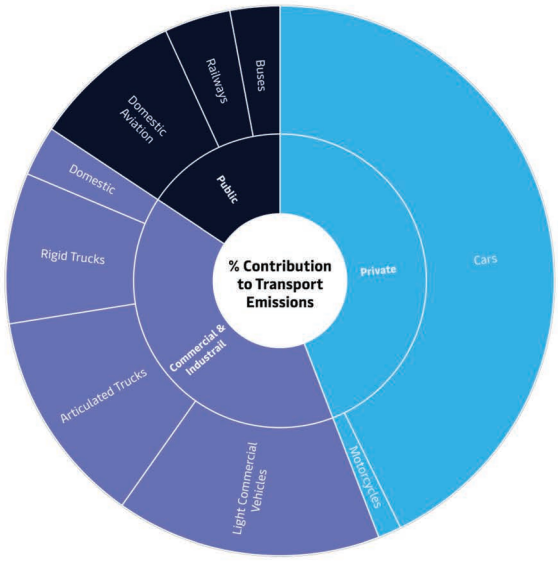
Exhibit: Market opportunity based upon wholesale revenue for India



*Market size as assessed by eninrac's domain specialists based upon the industry expert's inputs and viewpoints

Source: eninrac research & Channel checks

Exhibit: Emissions of transport by mode in India



Source: eninrac research & Channel checks

Market sounding and opportunity

Market sounding

As a part of the process of developing this report, eninrac consulting engaged with a range of stakeholders who are a part of or have links to transport industry, to gather their insights and perspectives on hydrogen. The stakeholder group encompassed Original Equipment Manufacturers (OEMs), fuel retailers, hydrogen distributors and commercial end users. All stakeholders have been anonymized within the body of this report, and it should be noted that the conclusions and recommendations contained within this document do not necessarily reflect the views of the organizations that were consulted as part of the market sounding through "VoC" survey.

Benefits of the opportunity for India

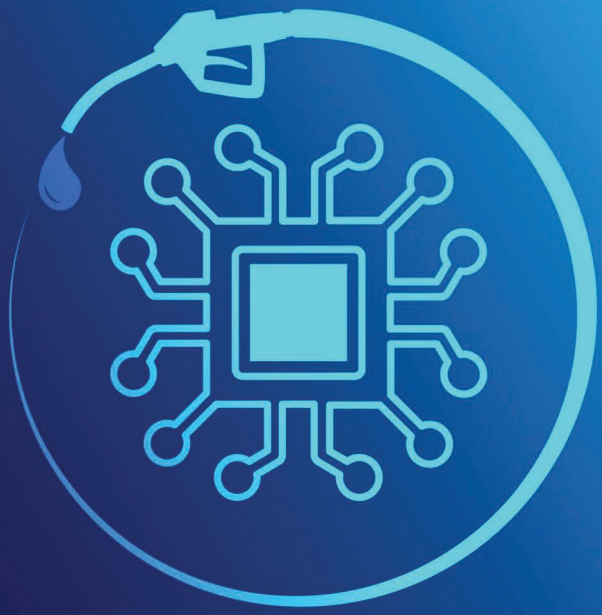
Using hydrogen as fuel transport is likely provide number of benefits to Indian industries and transport sectors which by and large will benefit the automotive industry as well. The primary reasons as to why hydrogen evolves as a credible fuel alternative source:

1. **Fuel security:** Hydrogen is a fuel source that can be produced through chemical processes (e.g., electrolysis). This presents the opportunity to create a fuel supply chain wholly within India. The ability to reduce reliance on overseas supplies of liquid fuels, and hence increase local fuel security.

2. **Improvement in air quality and emissions:** Fuel cell technology produces no direct emissions, and this has the prospect to reduce air pollution, which is currently contributed to by petroleum and diesel-powered transport. Furthermore, hydrogen that is derived from renewable energy sources (so-called 'green hydrogen'), presents the opportunity to introduce a carbon-neutral fuel source into the transport energy mix

3. **Use and range:** Hydrogen transport technology offers a similar user experience to incumbent technology, including the driving experience, driving range, and refueling time. These characteristics make hydrogen technology attractive as a substitute to incumbent technology in a broad set of applications.

Piloting, MVA & FCT



Hydrogen refueling infrastructure within India is very nascent with only few live examples of the technology. Furthermore, these examples are mainly within PPP mode or private mode and not readily available for public use. In this chapter we shall be discussing market for H2 transport technologies coupled with global case study for user choices.

In this chapter

20 Market for hydrogen transport technology
23 Defining successful piloting
24 Multi-criteria analysis
26 Fuel cell technology & FCEV application
29 TCO & User choices

Market for hydrogen transport technology

Fuel supply and refueling infrastructure

There are four developed approaches to hydrogen refueling. Industry consultation during the "VoC" suggests that either decentralized electrolysis (the process of using electricity to split water to produce hydrogen), or hydrogen gas offtake from centralized facility (producing hydrogen for other applications by one of a variety of methods, as discussed in previous sections of the report.

Hydrogen refueling infrastructure within India is very nascent with only few live examples of the technology. Furthermore, these examples are mainly within PPP mode or private mode and not readily available for public use.

In most instances, the assessment of potential hydrogen trials and pilots has included the costs required to procure and implement hydrogen refueling technology. The assessment, however, leaves the technology used as deliberately generic – it does not specify whether the refueling is centralized, decentralized or the delivery method of the hydrogen fuel, where applicable. Our research suggests that the refueling technology choice is mostly agnostic to the use case and more dependent on the geographical and supply chain constraints of each specific project.

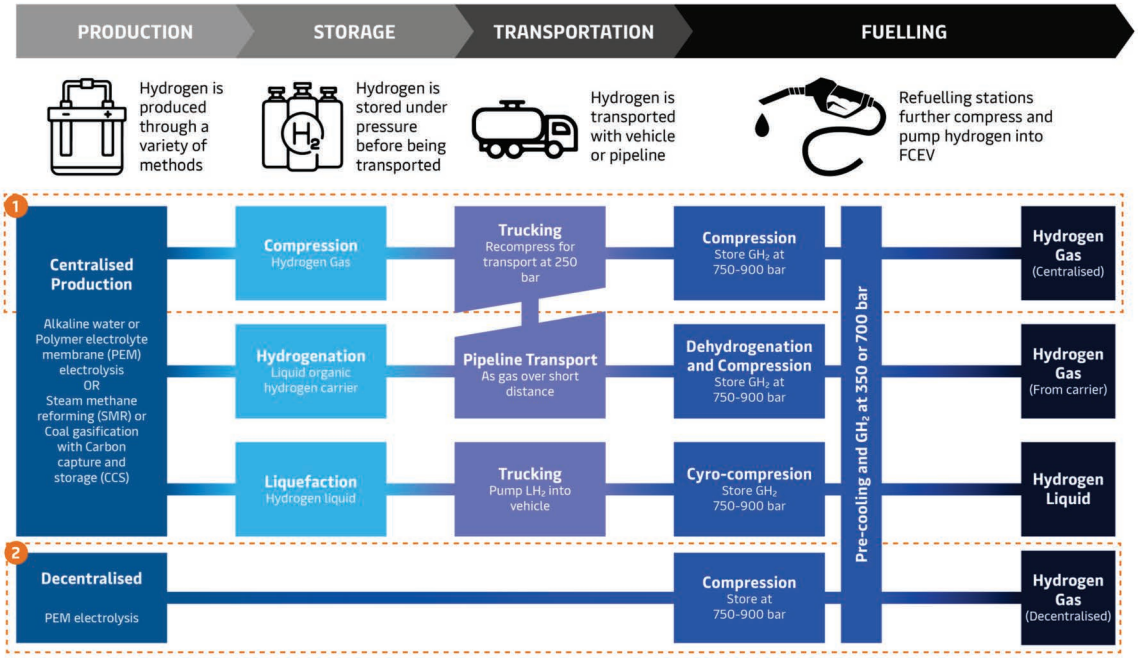
For the most part, however, these considerations are downstream of this study and therefore not considered in detail when determining the relative strengths and weaknesses of each hypothetical project.

Table: Key consideration for choice of hydrogen refueling technology

Location	▪ A centralized hydrogen supply chain relies on the availability of road transport (tanker trucks) to transport gaseous hydrogen to refueling stations ▪ Decentralized electrolysis can be based anywhere, but will require substantial site footprint for production and compression
Energy Supply	▪ Creating green hydrogen requires readily accessible renewable energy sources ▪ Decentralized electrolysis may be favorable on sites which have excess renewable energy production (e.g., rooftop solar at a warehouse, or a solar farm adjacent to a mine site)
Hydrogen Supply	▪ Hydrogen is currently produced and used in industrial applications ▪ Opportunities to interact with this supply chain would be advantageous, but most industries do not use green hydrogen

Source: eninrac research & Channel checks

Exhibit: Possible hydrogen (as a transport fuel) production pathways for India



Source: eninrac research & Channel checks

The market for hydrogen transport technology

The opportunity for implementing hydrogen as a transport technology spans across multiple modes. Each application has different characteristics, and these affect the opportunities for implementing trials, demonstrations and pilots. The methodology had a four-point central framework as defined below:

Exhibit: Methodology for transport technology in India

1. **International market scan**
2. **Identify four preferred modes**
3. **Consider opportunities & constraints**
4. **Consider key success criteria**

Source: eninrac research & Channel checks

Exhibit: Methodology expansion for transport technology in India

1. **International market scan** — An international market scan based on desktop research of international opportunities relating to Hydrogen for Transport
2. **Identify four preferred modes** — Based on the likelihood of success in the Indian market, the study identified four transport modes for further analysis and development of pilots and trials
3. **Consider opportunities & constraints** — For each of the four transport modes, additional research was undertaken to develop scalable hypothetical project options for pilot or trial.
4. **Consider key success criteria** — Each of the hypothetical projects was assessed against a set of key success criteria to identify which of the projects presents as a preferred pilot or trial for deployment in India

Source: eninrac research & Channel checks

Defining successful piloting

A pilot or trial of an emerging technology can have several factors which determine whether it is a success within the market. Technology pilots are undertaken for several reasons. For example, a new technology may be piloted to prove the operational performance and test the user experience. Alternatively, the pilot may aim to create end user awareness and encourage broad adoption of a new technology. Key themes that are considered central to the success of the hydrogen for transport in India.

Table: Key success criteria for hydrogen for transport

Strategic growth	The ability for the project to advance the strategic interests of India's hydrogen economy. This considers elements such as: ▪ How well the opportunity can support the GoI to build a clean, innovative and competitive Indian hydrogen industry that is a major global player by 2030 ▪ The value the opportunity contributes to the broader hydrogen value chain ▪ How well the opportunity progresses the hydrogen agenda across commercial, regulatory, technological and social dimensions
Addressable market	The ability for the project to grow the use case beyond the life of the trial, including: ▪ The likelihood of the use case being undertaken more broadly within the relevant transport sector in India ▪ Ability to increase the volume of vehicles from a supply and infrastructure perspective
Relative performance	The competitiveness of the hydrogen use case compared to both the incumbent technology and alternative technologies. This will consider: ▪ The cost competitiveness of the technology relative to alternatives ▪ The availability and supply of the technology relative to alternatives ▪ The technical and operational characteristics relative to alternatives
Procure & implement	The ability to procure and implement the relevant trial technology, where: ▪ Indian specific operations will be considered in terms of procurement methods, standards and modifications ▪ Appetite of industry partners and user groups to facilitate implementation ▪ Capability (and perception) of proposed industry partners ▪ Appetite of the local value chain to facilitate implementation
User adoption	The ability for the project to influence the perception and behavior of the use case audience, including: ▪ The direct target market of the proposed use case ▪ The broader Indian public perception of the Hydrogen for Transport opportunity

Source: eninrac research & Channel checks

Multi-criteria analysis

The success criteria which hold central for India as indicated in the previous section were used to qualitatively score of the 9 hypothetical projects, building in the priorities of the GoI and National Hydrogen Mission by assigning a weighing criterion.

Exhibit: Multi-criteria analysis rationale & scoring

A pair wise ranking assessment determines the relative priority of each success factor

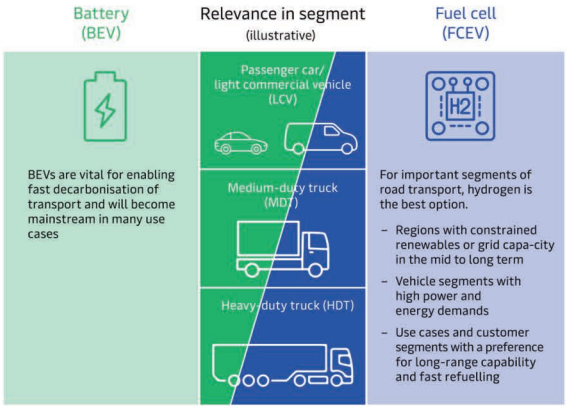
Criteria	Weighing
Strategic growth	**30%**
Addressable market	10%
Relative performance	**40%**
Procure & implement	15%
User adoption	5%

Source: eninrac research & Channel checks

Role comparison of BEVs and FCEVs

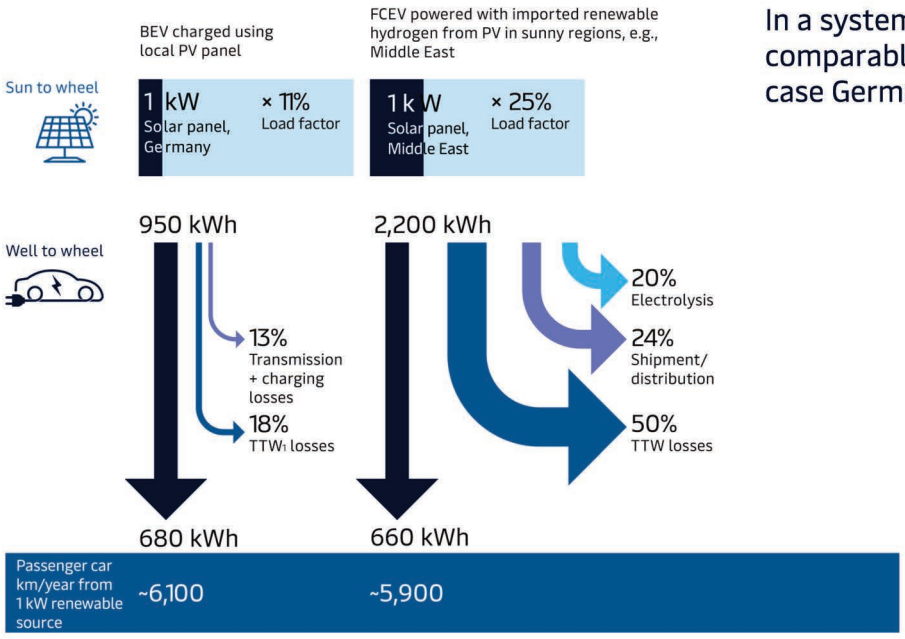
Hydrogen, however, has some advantages that make it more suitable for certain scenarios. In regions with a structural renewable electricity constraint and the need for imports, it makes sense to keep hydrogen as a molecule for as long as possible instead of converting it into grid electricity. Furthermore, hydrogen is well positioned for wherever large amounts of energy are needed for the vehicle performance due to the higher energy storage density of fuel cell systems. This is why we expect adoption both in passenger vehicles and, at a large scale, in commercial vehicles. Given the broad consensus on the role of hydrogen in heavy duty transportation, the following analyses focus mainly on passenger vehicles.

Exhibit: Mix of vehicle types required for India



Source: eninrac research & McKinsey

Exhibit: Illustrative pathway example: exact efficiency of each component can vary dependent on context



In a systemic view, BEVs and FCEVs have comparable sun-to-wheel efficiencies: case Germany

Source: eninrac research & McKinsey

Fuel cell technology & FCEV application

Broadly speaking, a fuel cell is an electrochemical reactor that converts the chemical energy of a fuel and an oxidant directly to electricity. More recently, the word fuel cell has been used almost exclusively to describe such a reactor using hydrogen as the primary source of energy. Hydrogen has a long history of being used as fuel for mobility. More than 200 years ago, hydrogen was used in the very first internal combustion engines by burning the hydrogen itself, like burning gasoline today. Fuel cells are typically categorized by the type of electrolyte used. Typical types of fuel cells electrolytes include Proton Exchange Membrane ("PEM"), Alkaline fuel cell ("AFC"), Phosphoric Acid Fuel cell ("PAFC"), Solid Oxide Fuel Cells ("SOFC") and Molten Carbonate Fuel cell ("MCFC")

Exhibit: Illustrative pathway example: exact efficiency of each component can vary dependent on context

Fuel cell type	Electrolyte type	Operating temperature (°C)	Catalyst type	Key advantage	Key weakness	Application
PEM	Proton exchange membrane	50-100	Platinum	Quick start, works at room temperature	Sensitive to CO, reactants need to be humidified	Vehicle power, portable power
AFC	Alkaline	90-100	Nickel/Silver	Quick start, works at room temperature	Need pure oxygen as oxidant	Aerospace & military
PAFC	Phosphoric acid	150-200	Platinum	Insensitive to CO_2	Sensitive to CO & slow start	Distributed generation
SOFC	Solid oxide	650-1000	LaMn03/LaCo03	Air as oxidant, high energy efficiency	High operating temperature	Large distributed generation, portable power
MCFC	Molten carbonate	600-700	Nickel	Air as oxidant, high energy efficiency	High operating temperature	Large distributed generation

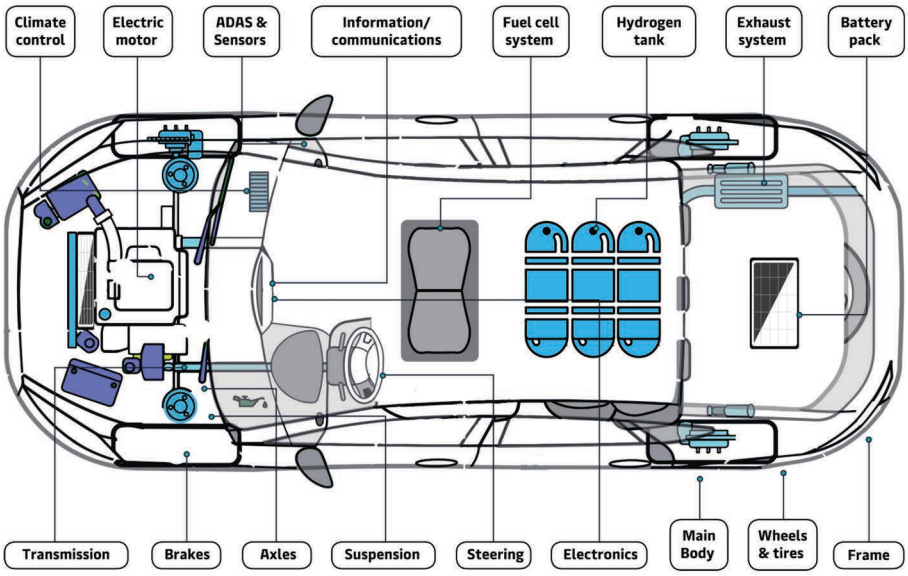
Source: eninrac research & Channel checks

Exhibit: Current and future number of FC vehicles by type and geography

		Passenger vehicles	Buses & coaches	Trucks	Forklifts	Refueling stations
USA	Current	7271	35 active, 39 development	Prototype test	>30,000	~ 42 online
	Target		5,300,000 FCEVs on US roads by 2030		300,000 by 2030	7,100 by 2030
China	Current	0	2000+	1500+	2	23
	Target	1,00,000 by 2030	11,600 commercial vehicles by 2023			500 by 2030
Europe	Current	~1,000+	~76	~100	~300	~152
	Target	3,700,000 by 2030	45,000 fuel cell trucks by 2030			~3,700 by trucks
Japan	Current	3,219	18	N/A	160	127;10 in progress
	Target	800,000 by 2030	1,200 by 2030		100,000 by 2030	900 by 2030

Source: eninrac research & Channel checks

Exhibit: FCEV Components



Source: eninrac research & Channel checks

TCO & User choices

TCO – USA Case Reference

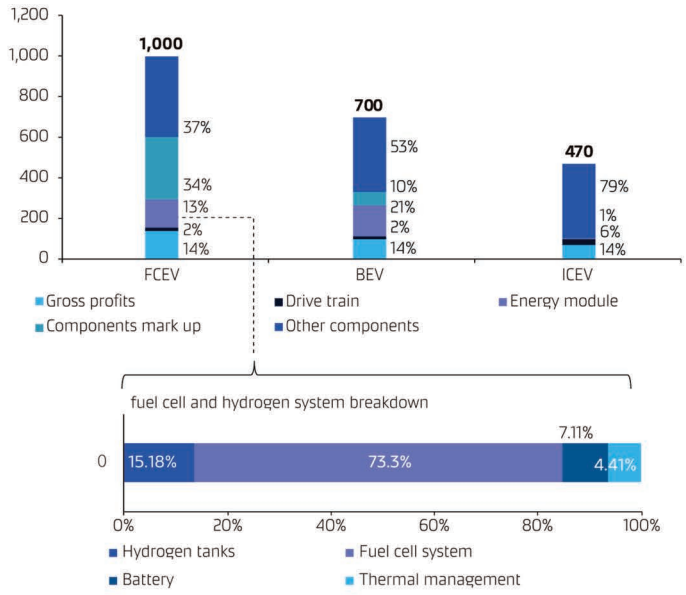
Here, we present a case study showcasing the Total Cost of Ownership (TCO) outcomes for the United States.

As evident from the illustration, the most significant disparities in costs arise from the energy module. The current pricing of the fuel cell system remains high, at roughly USD 1,500 per kilowatt (kW), constituting about 73% of the energy module expenses and approximately 13% of the overall cost of the fuel cell vehicle. Alongside the fuel cell system itself, the hydrogen tanks contribute to around 15% of the costs within the energy module. Collectively, these two constituents contribute the most to the cost escalation in comparison to the other two vehicles. Nevertheless, in line with the trajectory of nascent technologies, the costs of these components are steadily diminishing.

Apart from the energy module, noteworthy contributions to the overall pricing of FCEVs and BEVs come from the mark-up costs on components. Nonetheless, as anticipated, these component expenses are more modest for BEVs, owing to their earlier adoption and closer proximity to widespread market availability.

The collective viewpoint of industry experts we consulted indicates that FCEVs could achieve full economies of scale in approximately a decade. This achievement would lead to the removal of this supplementary component mark-up.

Exhibit: Total Cost of Ownership (TCO) outcomes for the United States



Source: eninrac research & Channel checks

Global Developments

In this chapter, we share the global development w.r.t. Private and Public transport & piloting projects which are in function along with their relevant business models.



In this chapter

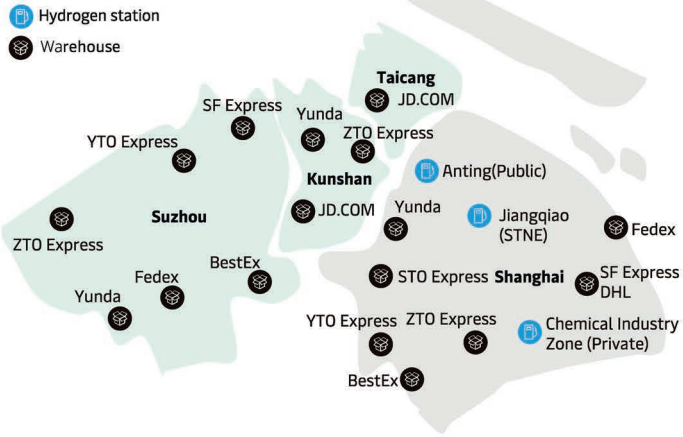
31 Private Transport & Piloting
32 Public transport & piloting

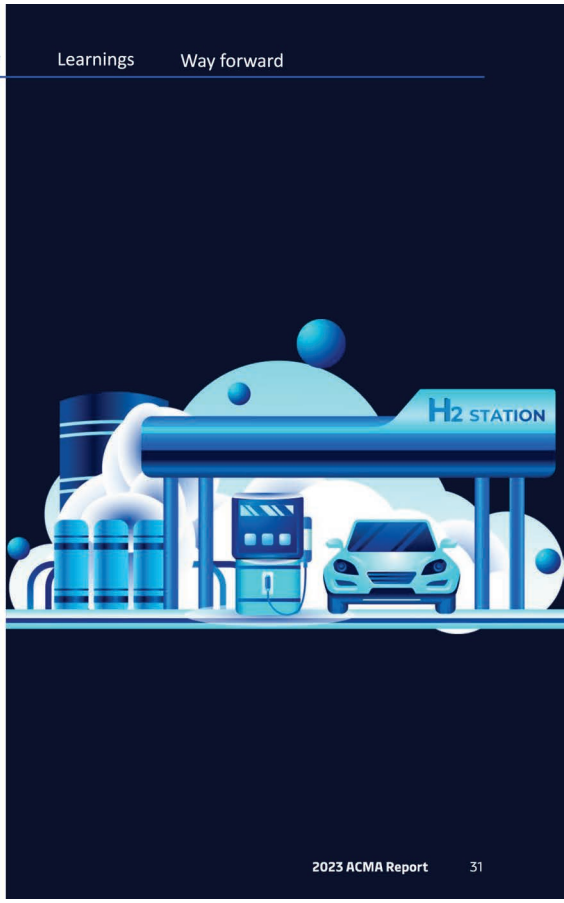
Tracking Global Developments

Private Transport & Piloting

Shanghai is one of leading fuel cell application cities in China. There are currently three hydrogen stations running in Shanghai, which are in Jiading, Feng Xian and Jiangqiao respectively. Furthermore, 13 hydrogen stations are in site selection stage as Shanghai continues to expand on its hydrogen infrastructure. As a major logistical focal point for surrounding regions, many logistics companies have built a network of logistics centers and warehouses around the region. A network of hydrogen fueling stations will help move the city towards greener mobility solutions.

Exhibit: Shanghai's operating hydrogen stations- Status 2019





Public transport & piloting

Transport for London ("TfL") is the integrated transport authority responsible for the day-to-day operation of the city's public transport network including buses, the undergrounds, light railways, taxis, etc. In December 2003, TfL started its trial of the first generation of fuel cell buses in London to reduce air pollution in the city. This trial was also part of Hy Fleet: CUTE project, which brought together 31 partners from industry and government from across Europe aiming to push the development of hydrogen-based transport systems in Europe and was funded by the European Union and the UK government. After the successful trial, in 2010, as part of the Clean Hydrogen Cities project ("CHIC"), TfL purchased 5 next generation hydrogen fuel cell buses and put them into formal operation serving London citizens on the popular tourist route RV1 between Covent Garden and Tower Gateway. This is the first time a whole route has been fully operated by hydrogen powered buses in the UK. In 2013, TfL purchased three more hydrogen fuel cell buses and expanded the size of the fleet to eight buses. Then in 2015, TfL again added 2 more fuel cell buses to the fleet. At present, the ten zero emission fuel cell buses are serving London citizens on route RV1 in the city center of London. In May 2019, Transport for London ordered another 20-hydrogen fuel cell double-decker buses to expand its zero-emission bus fleet. The 20 hydrogen fuel cell buses will be put into operation in 2020 on routes 245, 7 and N7

Exhibit: Milestones of hydrogen fuel cell buses applications by TfL



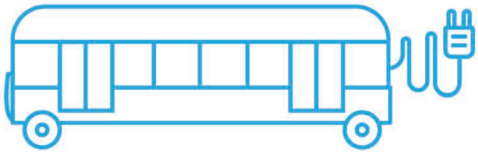
2003-2017	2010	2013	2015	2019
Trial Run	**Formal operation stage**	**Capacity Upgrade**		
• Started a trial of the first generation of zero emission fuel cell buses in city of London • Purchased 3 fuel cell buses run on Route RV1[209]	• Following the successful trial, 5 next generation hydrogen fuel cell buses were purchased and put into formal operation on route RV1[210]	• In 2013, 3 additional hydrogen fuel cell buses joined the fleet [210] • In December 2015, purchased 2 hydrogen fuel cell buses from Van Hool in December 2015 [211], the size of the fuel cell fleet reached 10 • Ordered another 20 fuel cell double-decker buses from Wrightbus in May 2019 [212] • The 20 buses will be put into operation starting 2020 on routes 245, 7 and N7 [212]		

Exhibit: Parameters contrast of different types of buses



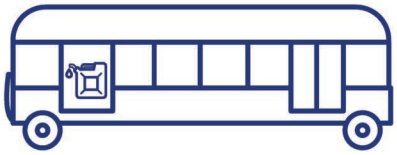
FCEV [214]

- Electric motor capacity: 200 kw (around 270 HP)
- Fuel cell system capacity: 30-100 kw
- Load capacity: 85 passengers
- Driving distance: Avg. 350 km, up to 500 km



BEV [215]

- Electric motor capacity: 200 kw (around 270 HP)
- Battery capacity: 382 kwh [216]
- Load capacity: 84 passengers
- Driving distance: ~250 km [215]



ICEV

- ICE capacity: 310 HP [217]
- Load capacity: ~120 passengers
- Driving distance: >300 km

Exhibit: Business model of London buses operation

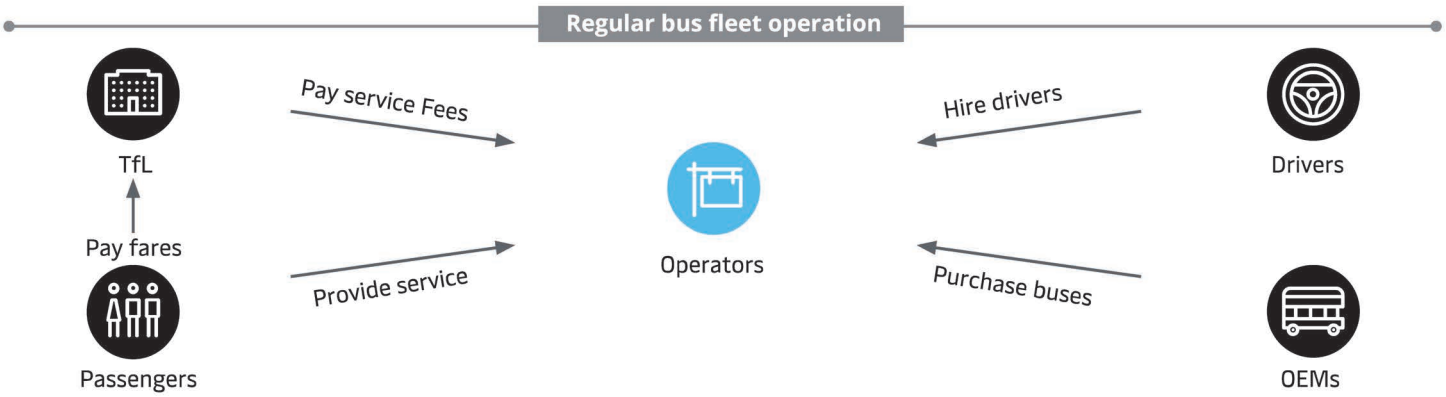
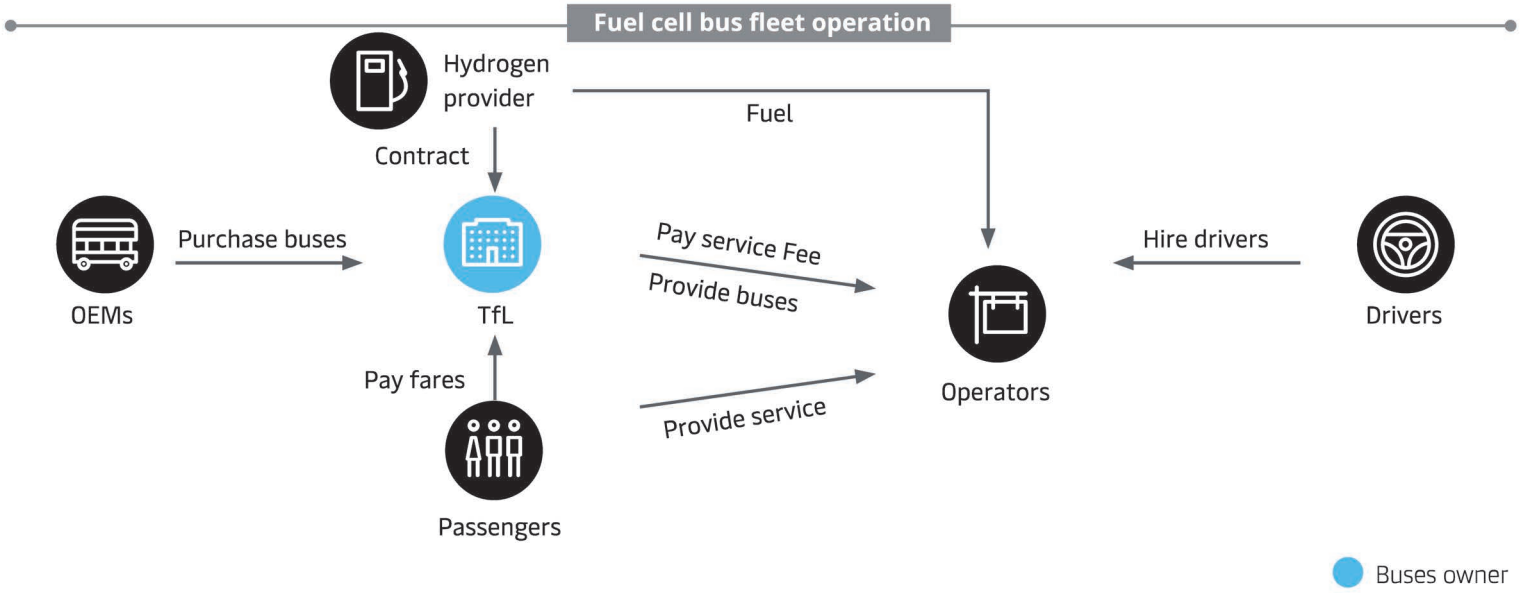


Exhibit: Business model of London buses operation (contd.)



Opportunities for India & integrated outcomes

In this chapter, we have covered the assessment of prospective trials was considered from two perspectives. Firstly, this study utilizes a multi-criteria framework to 'score' the outcomes of each trial; secondly, a range of stakeholder engagements were conducted to elicit industry perspectives. This segment also highlights the systems thinking and integrated outcomes that are pertinent to the hydrogen for transport opportunity. In progressing any pilot or trial, we encourage investigation of long-term benefits to the broader transport system and growth of the domestic hydrogen economy.

In this chapter

37 Opportunities for assessed hypothetical projects & relevant pilots

51 Integrated outcomes



Opportunities for India & integrated outcomes

Opportunities for assessed hypothetical projects & relevant pilots

Having evaluated fleet vehicles, passenger buses, material handling and goods vehicles to be the best opportunities for trials in India, specific hypothetical projects were developed. The use cases are defined by their mode and the scale of capital investment required to implement them. In this way, consideration is given to stand-alone projects and wider integrated systems. The technology components of the use cases are based on preliminary findings from trials overseas. To know the accurate cost to implement such a project in India, suppliers and operators should be approached for specific pricing. The following criteria for success of a trial have been defined for the assessment:

- Strategic growth
- Addressable market
- Relative performance
- Procurement and implementation
- User adoption

The highest-ranking use cases represent those most likely to result in successful trials which can be implemented in India

1	Poorly satisfies the criteria	2	Moderately satisfies some, but not all, aspects of the criteria	3	Moderately satisfies the criteria
4	Highly satisfies some, but not all, aspects of the criteria	5	Highly satisfies the criteria		



Exhibit : Summary of assessed hypothetical projects

Mode	Use case	Scale	Technology	Application	Time to implement	Score
Passenger Fleet Vehicles	Bike Fleet	Small Trial	Trial of 275-unit fuel cell bicycle fleet in a pay-as-you-go use case	Suitable for use within an institution, highly visible, low set-up costs	6-12 months	2
	Gov't Fleet	Small Trial	Trial of a ~15 FCEV fleet with centralized refueling model	Most suitable for organization without a fleet agency	1-2 years	2.9
	Corridor Fleet	Medium Trial	Trial of a larger ~90 FCEV fleet with multiple refueling stations	Focus on developing a trial 'corridor' (e.g., frequented ride-sharing route)	2-4 years	2.8
	Hydrogen Demonstration Zone	Integrated Pilot	Implementation of a 3km Low Emission Zone or 'Hydrogen Demonstration Zone' with 375 FCEVs and eight HRS	Focused on helping the low emission transition of local companies and residents	4-6 years	3.5
Passenger Bus	Individual	Small Trial	Single bus (and associated infrastructure) procurement	Suitable as demonstration vehicle on short, repetitive journeys (e.g., Airport shuttle)	1-2 years	1.6
	Metropolitan	Medium Trial	Trial of a larger ~9 vehicle bus fleet with central refueling	Suitable to service known route with base depot and daily travel ~300km	2-3 years	3.8
	Park & Ride	Integrated Pilot	Trial of a larger 35 vehicle bus fleet supported by 3 refueling stations	Applicable for a Park and Ride (P&R) scheme across 3 commuter suburbs	4-6 years	3.5

Exhibit : Summary of assessed hypothetical projects

Mode	Use case	Scale	Technology	Application	Time to implement	Score
Material handling	Material handling	Small Trial	Trial of small fleet (~35 units) of forklifts or similar handling equipment	Suitable for a warehousing application with long periods of continuous use	1-2 years	3.4
	Mine haulage	Medium Trial	Retrofit of a diesel haul truck to a FCEV powertrain with single refueling point	Suitable for a demonstration project in partnership with mine	2-4 years	3.2
	Private rail link	Integrated Pilot	Demonstration of three FC locomotives on new section of private rail network	Can be a demonstration project in partnership with a private rail operator	4-6 years	2.9
Good Vehicles	**Gov't logistics**	**Small Trial**	Trial of ~4 vans with centralised refueling point	Suitable for hub and spoke logistics, such as council building maintenance	**2-4 years**	2.3
	Last Mile	Medium Trial	Trial of ~25 van fleet with single refueling station for urban delivery	Suitable for government or private logistics	2-4 years	2.9
	Road Freight	Integrated Pilot	Trial of ~90 vehicle truck fleet with nine distributed refueling stations	Suitable for government or private industry logistic partnership	4-6 years	3.2

Exhibit: Government Fleet Opportunity Assessment

	Comments	Score
Strategic Growth	• A small fleet opportunity may have low public visibility, but will contribute to strategic priorities • The opportunity can allow for the establishment and sharing of refueling infrastructure with other fleet use cases (e.g., bus fleets within the same catchment)	4
Addressable Market	• Multiple avenues to pursue the fleet opportunity (i.e., local government, public and private sector) • Initial focus on trials within public sector fleets	4
Relative Performance	• Range and usage pattern like incumbent ICE cars • Capital cost of FCEV is ~3-4x cost of average ICE car	1
Procure & implement	• Preferred direct procurement or control (performance specifications) to the organization's fleet company • Procurement challenge will remain with refueling infrastructure – can leverage R&D trials (e.g., match funding with a multi-national)	5
User Adoption	• Broadly good adoption expected – no major negative responses unless refueling behavior is prohibitive • The costs on a per-km basis would be high (~2x currently), public perception of this needs to be managed	3
	• **Total weighted score**	3.8

Hypothetical Case I - Government Fleet

A small public-sector fleet of around 15 vehicles would have a broad set of applications. Strategically, such a fleet would allow for public demonstration and the establishment of refueling infrastructure in metro areas (e.g., near a town hall, or maintenance depot). This pilot is considered appropriate for a small impact demonstration, notwithstanding the likely competitiveness of BEVs at this scale

Key learnings from stakeholders

Cost consciousness is likely to limit the appetite for individual companies to switch to FCEVs. The fleet purchase will need to be incentivized and be cognizant of asset depreciation.

"...everyone wants to do something [in terms of low-emissions transport] but most companies don't want to pay more for their energy usage..." – OMCs

The relative performance of FCEVs in this segment is not strong when compared to BEVs. "...the battery electric market is moving so quickly, and their prices continue to fall. FCEV may find a segment that they're good for but in terms of a viable alternative for small vehicles it seems unlikely..." – OMCs

Exhibit: Corridor Fleet Opportunity Assessment

	Comments	Score
Strategic Growth	• Substantial size of fleet would create specific demand for refueling infrastructure and new OEM vehicle imports • Significant opportunity as there are over 2 million fleet cars in India	3
Addressable Market	• Multiple opportunities to integrate within existing fleets of Government and/or private businesses • Limited to businesses which use vehicles with predictable, frequent routes (e.g., delivery services, maintenance and operations)	3
Relative Performance	• High capital costs relative to incumbent combustion vehicles (~3- 4x)	2
Procure & implement	• Range and usage pattern like incumbent combustion engines	4
User Adoption	• Useability like incumbent vehicles • Users need to be comfortable with back-to-base refueling arrangement	4
	• **Total weighted score**	2.8

Hypothetical Case II – Corridor Fleet

A fleet of this size would be appropriate in several public sector and commercial applications. Businesses, however, would need to have 'back-to-base' operations to make hydrogen competitive to alternatives. While a 90-unit fleet is an attractive proposition, the procurement difficulties and high costs are likely to make this opportunity unattractive to a large portion of commercial businesses.

Key learnings from stakeholders

Car-share concepts have relatively low uptake in India. The fleet model, however, is seen as the most promising application for incorporating FCEVs into the private mobility market.

Indians like to own cars, so breaking consumer behavior is difficult from the perspective of uptake in fleet vehicles. It may be something we see in future generations, there is a trend of declining driver licenses…" – OMCs

Initial fleet users will need to be comfortable with back-to-base refueling arrangements and limited vehicle choice. OEMs will be reluctant to offer substantial range until demand is established.

Exhibit: H2 Demonstration Zone Opportunity Assessment

	Comments	Score
Strategic Growth	• High strategic potential to integrate a larger FCEV fleet with broader precinct and/or hydrogen hub outcomes • Coordinated effort with other low-emission technologies and policy mechanisms to support the transition	5
Addressable Market	• FCEV becomes more attractive with appropriate low-emissions policy– users are incentivized to adopt vehicles which mitigate emission charges. There is no existing market for this • A centralised hydrogen precinct approach is amenable to a concentrated demand of refueling infrastructure	1
Relative Performance	• Within a fleet scenario (taxi and/or car share) performance will be like incumbent combustion vehicles • Capital outlay would be 3x higher than traditional fleets (not including offsets associated with the low emissions mechanisms)	3
Procure & implement	• Procurement of many units (<500) will increase the timeframe for implementation as currently around 4,000 Mirais produced annually across the globe • Multiple refueling stations (12+) will be required to satisfy fleet	3
User Adoption	• If users are incentivized within a 'hydrogen demonstration zone', they are more amenable to investing in low emission vehicles • Users would require surety in the availability of refueling infrastructure, otherwise preferences would be given to other low emission technology (e.g., BEV or LPG)	5
	• **Total weighted score**	3.5

Hypothetical Case III – H2 Demonstration Zone

A large fleet (more than 500 vehicles) could be well utilized in conjunction with a broader low emission urban demonstration. Practically speaking, this would require both policy action (e.g., low emission zoning) and multi-modal adoption. Demonstration of a large-scale private vehicle fleet would be best supported through parallel implementation of policy mechanisms and creation of a 'hydrogen demonstration zone'

Key learnings from stakeholders

Creating surety of refueling demand (through 'hydrogen demonstration zone' policy mechanisms for example) is seen as an important measure to increase the uptake of a new technology

I think it looks worse when you build something, and the demand isn't there…we have a high-speed charger in Euroa that only gets used once or twice a month. Generally, from a small initiative point of view we would try and line up some of the demand before investing…" – OMCs

A collaborative effort between government, fuel suppliers and OEMs is seen as the best approach to increasing vehicle availability

Exhibit: H2 Bus & Metropolitan Bus Route Opportunity Assessment

A. H2 Bus

	Comments	Score
Strategic Growth	• Buses are highly visible and have a broad user base. A trial of this scale, however, it not likely to allow for a high degree of publicity	2
Addressable Market	• Application limited to a 'special transit' application (e.g., Airport shuttle, tourist bus)	2
Relative Performance	• An investment of this size it not conducive to good utilization of refueling infrastructure – cost vs. benefit rationale will be challenging • The upfront costs of the FCEV Bus are prohibitive (3-5x more expensive than incumbent vehicles) • Buses have a long asset life (20 years). Operators will be concerned with operational and depreciation implications	1
Procure & implement	• FC buses made overseas do not meet ADRs • Indian FC bus manufacture possible within 12 months with upfront investment	2
User Adoption	• The passenger experience will be improved (vibrations, noise, exhausts) when compared to diesel technology • Bus operators not inclined to make the switch, particularly the effort required to use and run a single FCEV	2
	• **Total weighted score**	1.6

Hypothetical Case IV – H2 Bus

Investing in a single hydrogen bus is considered to offer poor value for money. An investment of this scale would require a strong commitment from the asset owner to demonstrate the technology due to the high upfront capital costs. Investment in a single bus would be limited to a few applications (e.g., an Airport or Shopping Centre) and only relevant to organizations looking to improve their sustainability credentials.

Exhibit: H2 Bus & Metropolitan Bus Route Opportunity Assessment (Contd.)

B. Metropolitan Bus Route

	Comments	Score
Strategic Growth	• A dedicated hydrogen bus route is likely to have a good degree of visibility and public engagement • Bus operators will have the opportunity to prove the technology in a realistic operational environment	4
Addressable Market	• Multiple metro and regional bus operators would be appropriate to run a FCEV route • Other operations in the private sector are also appropriate	5
Relative Performance	• Good utilization of depot refueling infrastructure, although peak demand requirements will need to be managed • Fleet operators will be concerned with the long asset life (~20 years) and the implications this has on operational costs and asset depreciation	3
Procure & implement	• FC buses from OEMs abroad do not meet ADRs but Indian compliant FC bus is in development • Alternatively, a hydrogen-mixed fuel system could be incorporated into LPG gas buses (e.g., Euro 6 bus) - relevance of this to the Indian market is limited	4
User Adoption	• Public users will easily adopt a FCEV Bus. It is likely that the passenger experience will be improved (vibrations, noise, exhausts) when compared to incumbent diesel technology	5
	• **Total weighted score**	3.8

Hypothetical Case IV – H2 Bus & Metropolitan Bus Route

A medium scale investment (approximately nine vehicles) provides enough critical mass to service a specific metropolitan bus route. A fleet of this size would increase the utilization (and therefore cost effectiveness) of refueling infrastructure.

A moderately sized bus fleet has several benefits – it allows sizeable demonstration of the technology, and the opportunity for operational testing in a real-world application

Key learnings from stakeholders

If performance of hydrogen buses can be demonstrated (across the whole asset lifecycle) as comparable to existing diesel fleets, this will encourage fleet operators to explore hydrogen as a low emissions alternative to combustion engine vehicles

"...Fleet operators will be concerned about practical considerations. How many drivers do I need? Will this mean I need a new OEM relationship? Is the refueling the same amount of time? How will the asset depreciate over time..." – Hydrogen Technology Distributor

The long asset life of buses (20 years) makes it difficult to quickly convert a sizeable portion of the fleet to hydrogen

Exhibit: Material Handling Equipment Opportunity Assessment

	Comments	Score
Strategic Growth	• Opportunity to partner with commercial interests e.g., FMCG or supermarket who have high volume of stock movement • Poor public visibility, main benefit imparted to commercial interests	2
Addressable Market	• Wide range of users with material handling needs across a range of sectors • Opportunity to share refueling infrastructure with other transport modes at a single site	3
Relative Performance	• Some availability of commercially manufactured forklift units, which result in higher productivity • FCEV understood to perform better in both range and refueling requirements when compared to traditional BEV material handling	4
Procure & implement	• Preference to partner with commercial company who has sufficient Capital to invest in sustainability initiatives – link to corporate carbon reduction goals • Technology is well demonstrated overseas (e.g., Forklifts)	5
User Adoption	• If value can be demonstrated to commercial companies, broadly good adoption expected as seen globally • Value must be demonstrated in terms of end-to-end lifecycle cost as well as benefits such as reduction in downtime / number of units required to move same volume of material	2
	• **Total weighted score**	3.4

Hypothetical Case V – Material handling equipment

Material handling equipment is a large and diverse market, and there is significant opportunity to penetrate markets with industry participants who are looking to reduce their vehicle emissions. Hydrogen is particularly attractive because of the opportunity to link with other industrial applications of hydrogen.

Several Indian businesses are well placed to undertake hydrogen trials in their logistics activities. Overseas success can be leveraged to demonstrate the benefits to end users.

Key learnings from stakeholders

Hydrogen vehicles have a greater range than electric vehicles, thus reducing the refueling / charging needs for material handling fleets

"...electric forklifts need many internal charging stations. Downtime could be minimized by transitioning from electric to hydrogen..."– Hydrogen technology distributor

Hydrogen forklifts are a relatively easy mode to build into an end-to-end logistics supply chain for bulk material handling, especially in cases where the hydrogen is being produced on site

Exhibit: Mine Haulage Equipment Opportunity Assessment

	Comments	Score
Strategic Growth	• Opportunity for Indian manufacturers to benefit from "first mover" advantage in this transport mode • If vehicle being used on private land initially, may not be subject to same level of regulation as public road use	4
Addressable Market	• Initial use in mining sector could grow into wider uptake for heavy vehicles once commercial viability is demonstrated • Typical load and haul fleet on mine sites between 30-100 vehicles	5
Relative Performance	• No data available on heavy haulage trucks however, based on light vehicle trials, performance is expected to be comparable to diesel, and better in terms of range/capacity compared to BEV • On-highway trucks are seen as preferred mode to trial and implement emerging technology	3
Procure & implement	• Supply chain is the greatest challenge for this transport mode currently. Currently only two companies have expressed plans to develop FC mining haulage	1
User Adoption	• Mining and heavy industry is used to managing risks with handling and processing hazardous materials - hydrogen is no different • Users are highly concerned with payload ability, operating efficiency and truck cycle time – hydrogen technology would need to demonstrate good performance in these areas	2
	• **Total weighted score**	3.2

Hypothetical Case VI – Material handling equipment

With such a large mining industry, India could be a first mover in this space and help to reduce the emissions of the global mining industry. Procurement and implementation of technology (e.g., a FC haulage truck) will be challenging and require local expertise. Hydrogen in the mining industry is strategically attractive, but local capabilities in fuel cell vehicle design and manufacture will need to be developed to produce operationally capable vehicles

Key learnings from stakeholders

The technology for heavy-haulage vehicles is still to be proven (compared with light vehicles and vans) which makes it even more important to support early pilots and trials

"...light vehicles using hydrogen batteries is proven... the technology for heavy trucks is more difficult due to the amount of torque needed..." – Global metals producer

Mining vehicles are specialized but the development would be for a market which is universal across countries. India would likely be able to support manufacture through self consumption initially

Exhibit: Opportunity Assessment for Railway Link under PPP

	Comments	Score
Strategic Growth	• Opportunity to integrate rail link into an existing bulk material handling supply chain to "value stack" and share the costs of production and refueling infrastructure across multiple modes	3
Addressable Market	• Private freight rail could be used to demonstrate technology in country before expanding into longer-haul freight distances	4
Relative Performance	• Electrification of remote lines is not economically viable, and hydrogen provides a similar range to diesel. The technology can be used as a low-emission alternative to existing diesel locomotives	3
Procure & implement	• Most viable option would appear to be for a commercial company requiring bulk material handling to integrate a private freight rail link as part of its end-to-end logistics supply chain • High capital costs, but can be reduced if integrated into a brownfield site where rail infrastructure already exists	2
User Adoption	• Mining and heavy industry is used to managing risks with handling and processing hazardous materials, so hydrogen is perceived as no different • Low public interaction anticipated in mine remote locations	2
	• **Total weighted score**	2.9

Hypothetical Case VII – Railway Link Assessment under PPP

A hydrogen-powered rail link could facilitate a large mine to transport output to a distribution hub. FC locomotives could be developed domestically or with existing expertise internationally. A fixed, high utilization route (e.g., bulk-freight component to a supply chain) would provide an alternative to diesel and generate demand for hydrogen. India has many private rail operators who could run a pilot. The unproven performance and long development times are likely, however, to hold back commercial investment

Key learnings from stakeholders

There is an opportunity to leverage existing in country manufacturing, and produce hydrogen trains in India

Partnerships and co-investment from commercial entities and the Government will support first-mover trials and refueling infrastructure

Exhibit: Opportunity Assessment for Government & last mile logistics

A. Government Logistics

	Comments	Score
Strategic Growth	• Commercial fleets offer the opportunity to prove FCEV technology, but this scale is too small to be impactful • Light commercial vehicles can form part of a hydrogen-powered supply chain	2
Addressable Market	• There are a broad set of applications suitable for a small FCEV logistics fleet and can be used as the first stage of a fleet-wide replacement of ICEs	3
Relative Performance	• A FCEV fleet performs well in a hub-and-spoke model • Small businesses would be concerned about managing peak demand with one HRS (e.g., morning and night refueling)	2
Procure & implement	• Vehicles could be procured directly from OEMs (traditional or non- traditional) • Alternative ownership structures (e.g., service level agreement based) would offer a lower risk entry for small to medium enterprises	3
User Adoption	• Most medium enterprises are very cost sensitive when it comes to fuel and energy costs, so likely to form part of a larger existing fleet • Adopters would need to be incentivized to undertake the investment and operational risk	2
	• **Total weighted score**	2.3

Hypothetical Case VIII – Government logistics

A small trial of four back-to-base vans which can be introduced to an existing fleet along with an HRS which could be made publicly available. Low utilization of refueling infrastructure could be overcome through partnering with another trial or through staged increase of the fleet. A small fleet, while operationally feasible, does not offer many strategic benefits or commercially attractive outcomes for businesses

Key learnings from stakeholders

Achieving attractive vehicle costs may focus on importing through emergent, non-traditional OEMs

A FCEV fleet has considerable upfront investment costs (and therefore investment risks). This could be mitigated through an alternative ownership structures that is more akin to models seen in the sharing economy

Exhibit: Opportunity Assessment for Government & last mile logistics

B. Last Mile Logistics

	Comments	Score
Strategic Growth	• Demonstration of a logistics fleet of this size would increase industry confidence in commercial viability of the concept • Commercial logistic operations could test hydrogen technology in demanding conditions	3
Addressable Market	• For metro-operations, the fleet would be highly visible and could play to an organization's broader sustainability goals	5
Relative Performance	• Capital outlay is high compared to traditional vehicles, and operational costs have the potential to escalate beyond traditional trucks and vehicles • Performance of the technology can be improved through an integrated logistics hub (incorporate onsite hydrogen generation of ~0.5-1MW) and renewable energy generation	2
Procure & implement	• Procurement could be undertaken directly through OEMs, but commercial users would need incentives to compensate for higher costs and increased operational risk	3
User Adoption	• Most commercial businesses are cost-sensitive and likely to be reluctant to adopt the technology • This is balanced, however, by the strong opportunity for credible social license afforded by the hydrogen opportunity	4
	• **Total weighted score**	2.9

Hypothetical Case VIII – Government logistics

A larger commercial fleet could perform well in urban logistics (e.g., 25 FC vans within an existing fleet). A scale of such size could enable early logistics within a LEZ and provide infrastructure to promote the uptake of FC vehicles by others. A mid-sized fleet of commercial vehicles could perform well in several applications. While upfront costs are high, the whole of life value proposition may be compelling

Key learnings from stakeholders

At fleets of this size, logical partnerships are with commercial customers who have a willingness to participate in emissions reduction and partner on roll-outs

The practicalities of running a commercial fleet will also need to be considered. Operational considerations will be of a high priority

Exhibit: Opportunity Assessment for Road Freight Corridors

	Comments	Score
Strategic Growth	• An integrated hydrogen corridor or hydrogen highway will leverage India's high kilometer reliance on road freight • Highway infrastructure can be shared between commercial, private and government interests	5
Addressable Market	• Utilization would focus on partnership with major national freight and logistics (for example major ports like JNPT, Deen Dayal, Tuticorin etc. & large private ports like Mundra)	4
Relative Performance	• Economies of scale are more achievable in a larger fleet arrangement owing to the volume of hydrogen fuel required (~20x more than a private vehicle)	2
Procure & implement	• Government would be relied upon to procure and implement depot / public refueling infrastructure (coordinated with existing refueling entities) • Logistics partners would need to be guided and incentivized to purchase FCEV fleet	2
User Adoption	• Centralised investment in a corridor of infrastructure can encourage the uptake by multiple commercial users (freight, logistics, mass transit)	3
	• **Total weighted score**	3.2

Hypothetical Case IX – Road Freight Corridors

A fleet of 90 semi-trucks can provide bulk-freight along an intra-state or inter-state route. This could become a hydrogen mobility corridor as part of a hydrogen-powered supply chain. A large fleet is attractive as the catalyst for a 'hydrogen corridor' – a known intra-state or inter-state route, where utilization of refueling infrastructure is high

Key learnings from stakeholders

Investment of this scale will need a high degree of industry coordination in order to sure-up demand and justify the infrastructure utilization

Access to vehicles is the greatest barrier to commencing any pilots and trials for this use case. Users are willing and ready to support the first trial programs in India

Integrated Outcomes

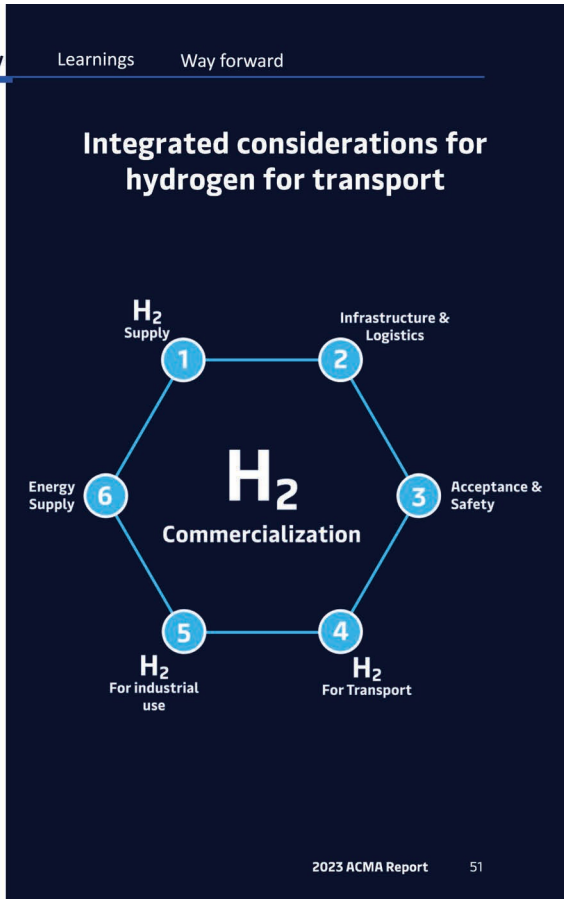
The four concepts take each of the four transport modes (i.e., fleet cars, buses, material handling and goods vehicles) and envisages an optimal, integrated end state for each.

Concept 1 is a hydrogen highway. This provides shared refueling infrastructure along a highly-utilized route which is used by passenger vehicles (both public and private), commercial vehicles and goods vehicles. This would result in decarbonization of long-distance transport along the route, which would be best situated between major economic centers.

Concept 2 is an industry focused system to transition mining and heavy industry to hydrogen. This concept plays to hydrogen's strength in heavy, long-distance transport, while also incorporating corporate fleets and material handling to increase infrastructure utilization. This concept has a local hydrogen ecosystem since often-mining sites or large heavy-industry plants are in remote areas.

Concept 3 is an urban integration of hydrogen technology. This means that multiple modes, including buses, fleet and private mobility, could leverage infrastructure provided within a specific urban catchment. Policy mechanisms could also be introduced within the catchment to incentivize the uptake of hydrogen and other low-emission technology

Concept 4 is a hydrogen-powered supply chain. This looks primarily at the logistics throughout a supply chain, from material handling for manufacture, through to local courier delivery. Since these activities are operated on a back-to-base model, it promotes high utilization of refueling infrastructure. These concepts use the principle of value-stacking to improve the cost-benefit of the individual trials by implementing them as part of a larger system.



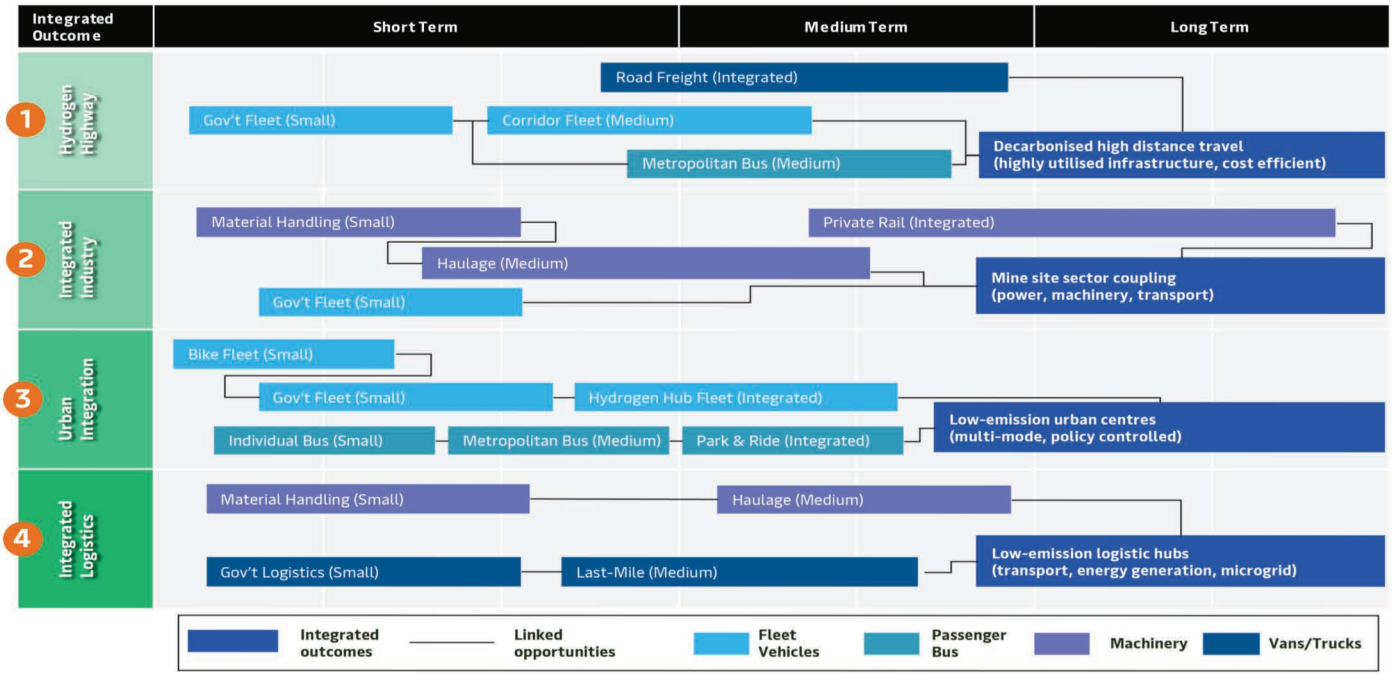
Introduction Background Piloting, MVA & FCT Global developments **Opportunity** Learnings Way forward

Exhibit : Integration outcomes for hydrogen for transport

Hydrogen Highway	Integrated Industry	Urban Integration	Integrated Logistics
Developing a hydrogen transport corridor	**Transitioning mining and heavy industry to hydrogen**	**Transforming personal mobility**	**Catalyst for the hydrogen powered supply chain**
Integrated Outcome Characteristics			
• Coordinate investment in medium scale fleets across logistics, mass transit and freight • Accelerate utilization of hydrogen infrastructure along specific travel corridors	• Cluster hydrogen transition within a specific mining region • Utilize hydrogen infrastructure across multiple use cases, both machinery and freight • Centralize hydrogen production support operations	• Create urban centers as the centerpiece for the hydrogen transition • Fleets of buses and rideshares share common-user refueling • FC bikes and scooters are subsidized and available to use refueling infrastructure	• Clustering of hydrogen fueled logistics activities • Leveraging multiple applications of a single commercial / industrial user • Focus on warehousing, storage, logistics, and onsite fuel production
Key Considerations			
• How can utilization be improved through multiple use-case sharing? • What is the optimal size of the hydrogen corridor (e.g., Gujarat to Maharashtra, UP to Rajasthan etc.)?	• What is the extent of applications that can be converted to hydrogen? • Can a mining town support its own hydrogen production facility?	• What is the level of investment required to support a micro hydrogen economy? • How can user adoption be ensured (through policy mechanism or otherwise)?	• How can government incentives best align with commercial interests? • How can incumbent users be incentivized to switch behavior?

2023 ACMA Report 52

Exhibit : Coordination of Individual Pilot Projects for Integrated outcomes



Source: Eninrac, Aurecon

Learnings from Indian & global stakeholders

In this chapter, we share the key learning for India from global markets for adaptability of hydrogen fuel cells vehicles along with different procurement models being adapted across the different countries.



In this chapter

55 Learnings for India from Globe

62 Procurement models – Enhanced outcomes

Learnings from Global Stakeholders for India – Route to Commercial Models

Learnings for India from global markets for adaptability of hydrogen fuel cells vehicles

Electric vehicles segment has grown significantly across the globe over the past couple of years. In the course of just five years, from 2017 to 2022, EV sales jumped from around 1 million to more than 10 million. The sales of EVs are expected to continue strongly through 2023. Having said so, fuel cells too are gaining momentum with a good reason to promote clean mobility. Hydrogen could play a vital role in the renewable energy system & in the future mobility.

Hydrogen & batteries are often portrayed as competing technologies & batteries have gained a lot of attention in the recent years. The relative strengths and weaknesses of these technologies, however, suggest that they should play complementary roles. Battery electric vehicles exhibit higher overall fuel efficiency if they are not too heavy due to large battery sizes, making them ideally suited for short-distance and light vehicles. Hydrogen can store more energy in less weight, making fuel cells suitable for vehicles with heavy payloads and long ranges. Faster refueling also benefits commercial fleets and other vehicles in near-continuous use.

As with most of the initial development and deployment phases of fuel cell technology is heavily dependent on government policies and incentives. To various extents and for various reasons, governments of China, US, European nations and Japan have promoted the development of the fuel cell industry, investing heavily in the core technology research and establishing subsidy policies and medium/long-term strategic plans. Snapshots of hydrogen fuel cell policy for major global markets can be seen in following Exhibit.

Exhibit : Snapshots of hydrogen fuel cell policy for major global markets – Key Take Aways for India

Policy Segments	United States	China	Europe	Japan
National Strategy	• As early as in 1990, the US government published the Hydrogen Research, Development And Demonstration Act, formulating 5-year plan for hydrogen energy R&D • Due to the long period of hydrogen development, the United States has formed a systematic basket of laws, policies and scientific research plans to promote hydrogen energy	• Although comparatively late in development compared to other nations, China is putting a strong focus on hydrogen • Hydrogen was listed as one of the 15 key focus areas of China's energy strategy and technology innovation plan in 2016 • During the 2019 Two Sessions (a public national meeting to discuss governmental results), hydrogen was written into the government work report for the first time	• In 2003, the 25 EU nations launched the European Research Area ("ERA") project, which includes the building of the European hydrogen and fuel cell technology research and development platform • In 2019, Fuel Cells and Hydrogen Joint Undertaking ("FCHJU") released the Hydrogen Roadmap Europe, which proposed a roadmap for hydrogen energy development towards 2030 and 2050	• Hydrogen was established as a "national energy" of Japan, and the government has committed to make Japan a hydrogen society • In 2014, Japan launched the fourth Strategic Energy Plan and published the Strategic Roadmap for Hydrogen and Fuel Cells, outlining an integrated approach to hydrogen production, storage, transportation and applications
Hydrogen Production & Distribution	• In 2019 DOE issued a funding opportunity announcement for up to $31 million in funding to advance the H2@Scale concept, including innovative concepts for hydrogen production, and an integrated production, storage, and fueling H2@Scale pilot system	• No clear nation-wide subsidies or policies on hydrogen production & distribution • The current classification of hydrogen as a Hazardous Material is one of the major policy barriers to be overcome	• Relative high focus on clean production of hydrogen going forward • Hydrogen Roadmap Europe: a transition to one-third ultra-low carbon hydrogen production by 2030	• Strategic Road Map for Hydrogen and Fuel Cells: – Building up a commercial-based domestic system for efficiently distributing hydrogen by mid-2020s • Full-fledged operation of manufacturing, transportation and storage of zero-carbon emission hydrogen by 2040

Exhibit : Snapshots of hydrogen fuel cell policy for major global markets (Contd.) - Key Take Aways for India

Policy Segments	United States	China	Europe	Japan
Hydrogen Infrastructure	• The DoE launched H2USA — a public private partnership with FCEV OEMs, focusing on advancing hydrogen infrastructure • The California Fuel Cell Partnership ("CaFCP") has outlined targets for 1,000 hydrogen refueling stations by 2030	• No clear nation-wide subsidies or policies on hydrogen infrastructure • Several city-level government like Foshan, and Zhongshan city are setting local subsidy policies • However, approval procedures for hydrogen stations are still unclear	• In 2009, Germany established H2 Mobility, investing in world's first nationwide network of hydrogen filling stations • Hydrogen Roadmap Europe: 3,700 hydrogen refueling stations are expected by 2030	• From 2016-2018, the Ministry of Economy, Trade and Industry has provided ~$88million budget on R&D and ~$539million budget on construction subsidies of hydrogen fueling stations
Support for passenger vehicles	• The US government clarified the leading role of hydrogen energy in transportation transformation in the all-of-the-above Energy Strategy in 2014 • The California Fuel Cell Partnership has outlined targets for 1,000,000 FCEVs by 2030	• Subsidies to consumers on each FCEV sold are expected to last at least until 2025 • Like BEVs, the government is focusing first on commercial applications of FCEVs, which is easier to regulate and deploy on a large scale; this is not written into policy per-se, but more from a implementation perspective	• Hydrogen Roadmap Europe: 3.7 million fuel cell passenger vehicles on road by 2030	• Japan's hydrogen fuel cell vehicles are mainly passenger vehicles, starting from the R&D by OEMs which led to the release of the Toyota Mirai in 2014 • Target of 800,000 FCEVs by 2030 "Hydrogen Strategy 2017
Support for commercial vehicles	• In 2018, the California Air Resources Board ("CARB") has preliminarily awarded $41 million for the 'shore to store' project, developing 10 FC class 8 drayage trucks		• Hydrogen Roadmap Europe: 500,000 fuel cell LCVs, 45,000 fuel cell trucks and buses on road by 2030	• Target of 1,200 FC buses and 10,000 forklifts by 2030 "Hydrogen Strategy 2017

Exhibit : Improving Circular Economy of Automobiles in China" 's impact areas for the automotive market – Learnings for India

Parameters	Major Initiatives related to NEV promotion	Possibilities of implementation & potential benefit to hydrogen industry
Remove purchase restrictions	• Continue excluding NEV from purchase restrictions by local governments • NEV number plate restrictions to be removed (e.g., Beijing)	**High**
Upgrade rural consumption	• Encourage rural residents to replace old cars, and provide subsidies for NEV purchase	**Average**
Remove restriction on pickups	• Currently, pickups are classified as light trucks in China, and are applicable for all restrictions on truck • The removal of restrictions would unleash the demand for pickups in cities below the prefectural level	**Below Average**
Optimize charging infrastructure	• Charging facilities and right-of-way policies (e.g., Allow NEVs to use bus lanes) benefit NEV usage	**Above Average**
Scrap old vehicles	• Reward and subsidize the scrappage of passenger vehicles less than 10 years of usage when replacing them with NEVs	**Average**
Encourage auto leasing / auto finance	• Encourage long-term and short-term leasing and promote NEV rentals	**Below Average**
Electrify public vehicles (people & goods)	• Promote public service vehicles such as bus, sanitation, postal, commuter, urban logistics, etc., to upgrade to NEV	**Above Average**

Exhibit : Targets of Fuel Cell Vehicles in Major Global Markets

Vehicle Segment	US	China	Europe	Japan
Passenger Vehicles	• 1,000,000 by 2030		• 3,700,000 by 2030	• 200,000 by 2025 • 800,000 by 2030
Buses & Coaches	• 5,300,000 FCEVs on US roads by 2030	• 11,600 commercial vehicles by 2020	• 45,000 fuel cell trucks and buses by 2030	• 1,200 by 2030
Refueling Stations	• 300,000 by 2030			• 10,000 by 2030

Exhibit : Targets for the use of low carbon hydrogen in non road transport sub sectors across Europe

Mode of transport	Market	Targets
Rail	• France	• 12 trains by 2025
	• Portugal	• 1-5% of final energy consumption in rail met with hydrogen by 2030 and 5-10% by 2040
	• Slovak Republic	• 12 trains by 2030
	• Spain	• 2 commercial train lines operated with hydrogen trains by 2030
Shipping	• Portugal	• 3-5% of final energy consumption in domestic shipping met with hydrogen by 2030 and 1015% by 2040
	• Slovak Republic	• 2 ships by 2030
Aviation	• Germany	• 2% for hydrogen-based fuels in aviation fuel demand by 2030 • 200 000 tonnes of hydrogen-based sustainable aviation fuel in 2030
	• European Commission	• 0.7% share of synthetic fuels in aviation by 2030, increasing up to 28% by 2050
Forklifts	• Japan	• 1000 forklifts by 2030

Exhibit : Planned ban on Pure Internal Combustion Engine Vehicles in Major Global Markets

Country	Year to Ban Pure ICEVs
UK	**2040**
France	**2040**
Germany	**2040 (tentative)**
Spain	**2040**
Netherland	**2025**
Canada	**2040**
India	**2030**

Procurement Models – Enhanced Outcomes, Capturing Global Experience

Understanding FCEV, BEV and ICE applications in different vehicle types

FCEVs have a wide range of vehicle application types due to its simplicity and flexibility. FCEVs and BEVs are both alternative solutions to replace conventional gasoline and diesel vehicles to promote zero-emission and sustainable transportation systems. Many countries have introduced policies to ban internal combustion engine vehicles. Using clean vehicles such as FCEVs and BEVs is an undeniable trend for the future. Compared to FCEVs, the development and adoption of BEVs are more mature in most applications but suffer from limitations due to battery weight and range issues BEVs real world ranges typically have a large discount compared with its official range in lab conditions. Battery performance is also easily affected by external environment. Additionally, fuel cell vehicles offer a refueling experience like a conventional IC vehicle - there is no need for battery charging infrastructure, which can be difficult to implement at multi-unit dwellings (apartment buildings) and along highways . The full commercialization of the BEV and its charging infrastructure will lead to an impact on the grid system. As predicted by the UK National Grid, the power demand of BEVs will be around 45 TWh in 2050, representing around 10% of the power demand of the whole country.

Exhibit: Summary of fuel cell passenger vehicle application status

	China	Europe	Japan	US
Typical products available	• SAIC launched a plug-in hybrid FC version of Roewe 950 in 2016 • Grove, a Chinese fuel-cell vehicle brand, launched China's first fuel-cell passenger vehicle in 2019	• Toyota Mirai • Honda Clarity (leased only)	• Toyota Mirai • Honda Clarity (leased only) • Hyundai Tucson • Hyundai Nexo	• Toyota Mirai • Honda Clarity (leased only) • Hyundai Tucson • Hyundai Nexo

Exhibit : Summary of fuel cell passenger vehicle application status (Contd.)

	China	Europe	Japan	US
Application Status	• In 2018, no sales of fuel-cell passenger vehicles were achieved in China • 50 plug-in hybrid fuel cell version of Roewe 950 were used in a demonstration operation of UN project and car-sharing services in Shanghai	• 575 and 766 Toyota Mirai were sold in Japan in 2017 and 2018 respectively	• 132 and 160 Toyota Mirai were sold in Europe in 2017 and 2018 • Clever Shuttle and Bee Zero are car sharing companies operating with 20 and 50 FCEVs	• 1700 and 1838 Toyota Mirai was sold in 2017 and 2018 respectively
Level of Application	• Less than 100	• More than 500	• 100-500	• Above 500

Exhibit : Summary of fuel cell electric bus (FCEB) application status

	China	Europe	Japan	US
Application Status & cases	• In 2003, 3 Mercedes Benz hydrogen fuel cell buses were first tested in Beijing • In 2017, the first commercially operated fuel cell bus line in China was put into operation in Foshan Yunfu by Feichi Bus • As of 2018, there are over 200 FCEBs operating in cities including Shanghai, Foshan, Zhangjiakou and Chengdu	• The CHIC project, regarded as the first step of FCEBs application, deployed 60 buses in 8 countries during 2010-2016 • The JIVE project(Phase1) starting from 2017, will deploy 139 FCEBs in 5 countries with tech support from Ballard and other partners, of which 56 are in UK and 51 are in Germany 73 • Combing phase 2, JIVE will deploy nearly 300 FCEBs in Europe by the early 2020s	• In 2018, Toyota launched its first FCEB, Sora, and is expected to introduce over 100 buses within the Tokyo metropolitan area, ahead of the Olympic and Paralympic Games Tokyo 2020	• As of April 2019, there were 35 FCEBs were in active demonstrations in US, funded by NFCBP, TIGGER and other government programs, to identify improvement to optimize reliability and durability of FCEBs
Major OEMs	• Foton AUV • Yutong • Yong Man • Zhong tong	• Van Hool • Solaris • Wright bus	• TOYOTA	• New Flyer • ENC Group
Level of Application	• Above 200	• 100-500	• Less than 50	• Less than 50

Exhibit : Summary of fuel cell light & medium – duty truck application Status

	China	Japan	Europe	US
Application Status & cases	• STNE, the largest fuel cell vehicle operator in China, now operates ~500 FCEVs to serve logistics and e-commerce companies like JD and STO Express in Shanghai • 500 fuel cell trucks with 3.5-ton payload and a range ~330 km were deployed in Shanghai in 2018. The truck was produced by Dongfeng with Ballard fuel cell stack technology. • Shanghai Sinotran operates the fleet for intra-city deliveries. Another 600 fuel cell trucks were announced to be deployed on April 2019.	• In 2017, Toyota and 7-Eleven convenience stores reached an agreement to test and deploy fuel cell mid-size delivery trucks starting from 2019	• DHL is expected to deploy 100 "H2 Panel Vans" in Germany in 2020; the van is a 4.25-ton commercial fuel cell vehicles with a range of up to 500 km, manufactured by truck maker Street Scooter • H2ME is the major efforts to support the application of FC vehicle in EU that ~900 of Renault Kangoo FC vans will be deployed by 2021 and 170 have been deployed 88 for fleet and business operation	• Fuel Cell Hybrid Electric Delivery Van Project is a demonstration project led by DOE to increase commercial viability of electric drive medium-duty trucks. Currently 17 fuel-cell vans are in collaboration with UPS • FedEx started to test 20 fuel cell extended-range battery electric delivery van in California and Tennessee in 2014 and launched another test project with Workhorse and Plug Power for fuel cell delivery van in 2018
Major OEMs	• Saic Maxus • Feichi Bus • Dongfeng Trucks • Zhong tong Bus • Foton • Aoxin	• Toyota	• Renault • Street Scooter • Mercedes-Benz	• Workhorse • UPS • FEDEX
Level of Application	• Above 500	• Less than 100	• 100-500	• Less than 100

Exhibit: Summary of fuel cell heavy duty truck application Status

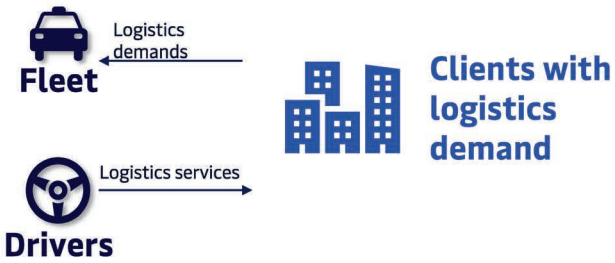
	China	Japan	Europe	US
Products available & in pipeline	• In 2017, Sinotruk announced the first heavy-duty truck in China, a fuel cell port tractor • Foton Motor Group is developing a prototype of a fuel cell heavy duty truck	• Toyota launched a Class 8 drayage truck in 2017 • No public deployment is observed	• ESORO launched world's first FC truck in the 34t category in 2017 • The H2-Share project, starting from 2017 to 2020, will build and test a 27-ton rigid truck developed by VDL in Europe • In 2018, Hyundai announced plans to provide 1,000 FC heavy trucks to H2 Energy, a Swiss company, from 2019 to 2023	• Fast Track Fuel Cell Truck project and Port of Los Angeles Shore-to-Store project were two representative projects in US to promote the application of fuel cell heavy duty truck, deploying 10 and 5 units respectively • Nikola Motor, a startup truck company in US, is planning to launch a Hydrogen fuel semi truck, Nikola Tre, which is expected to entry mass production in 2023. Anheuser-Busch has ordered 800 units
Major OEMs	• SINOTRUK • Foton	• Toyota	• E-Truck • ESORO • VDL • Hyundai	• KENWORTH • Nikola • TOYOTA
Level of Application	• Prototype Means no product is launched, companies are in the product development phase	• Prototype	• Demonstration Means prototype or product is tested or demonstrated on a small scale	• Demonstration

Exhibit : Summary of fuel-cell forklift application status

	China	Japan	Europe	US
Application cases	• The Foshan government in the Guangdong province plans to introduce 5,000 FC forklifts by 2025, although this is still at an early planning stage • Weichai has established a JV with Ballard Power Systems to develop fuel cells being utilized in forklift application	• In 2018, Toyota adopted 20 FC forklift trucks in its Motomachi factory, where it is also constructing a hydrogenation station	• Viessmann, a leading manufacturers of heating systems, announced that it had adopted a hydrogen forklift truck to undertake everyday warehouse operations in 2013 • Carrefour in Vendin-Le-Vieil, France, has purchased 137 forklifts from Still to operate in Carrefour's logistics base	• In 2014, Walmart began to cooperate with Plug Power to invest in forklifts. From 2014 to 2018, FC forklifts in Walmart warehouses has increased from 1,700 to 8,000 • In April 2017, Amazon announced partnership with Plug Power planning to deploy fuel cell forklift in its 11 warehouses
Major OEMs	• N/A	• Toyota	• STILL • Linde	• Hyster • Linde
Application status* *Indicated by estimated no. fuel cell forklifts in operation	Less than 100	100-1000	100-1000	More than 1000

Exhibit : Business Models of STNE (A Chinese hydrogen logistics platform startup)

Model I: Self Operation



Fee Rate

$43- $50

Industry typically charges per trip to clients, depending on distance and load

Model II: Direct Rental



$710- $860

Industry typically charges per month to clients with logistics demand

Exhibit : Business Models of STNE (Contd.)

Model III: Indirect Rental



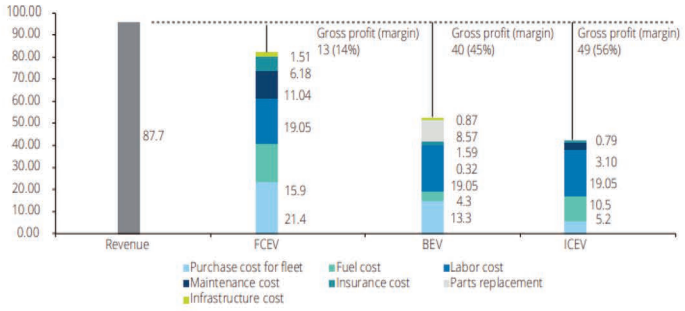
Fee Rate

$710- $860

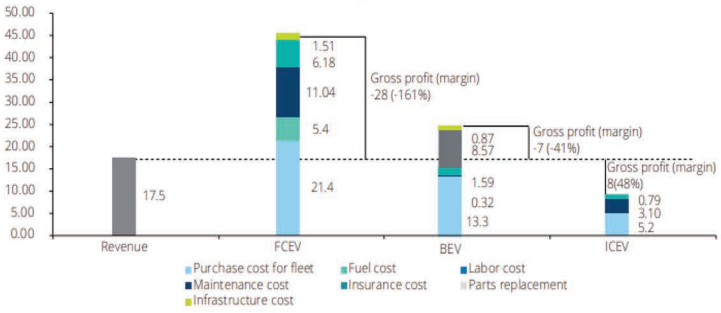
Industry typically charges per vehicle per month to third-party logistics providers, who then provide services to end-clients.

Exhibit : Total cost of ownership (TCO) estimation – self operation & renting out (USD/100 km)

TCO estimation – self operation (USD/100 km)



TCO estimation – renting out (USD/100 km)



Source: Eninrac, Deloitte

Way forward

In this chapter, we share the recommendations and conclusion for the research study which could help understand the roadmap for sustainability in India's automotive sector



In this chapter

71 Recommendations & Conclusion

Recommendations

Key Suggestions	Description
Supply (vehicles and infrastructure)	**We recommend that several avenues are explored regarding the supply of vehicles and infrastructure** There is a very limited set of hydrogen vehicles among traditional OEMs. For this reason, we recommend that trials consider as many avenues as possible regarding the procurement of hydrogen technology. Either 'non-traditional' OEMs or opportunities for in-country manufacturing should be considered for initial non-passenger trial opportunities.
Relative Performance	**We recommend bus, trucks and material handling are the most suitable pilots** Of all the use cases considered, bus and truck fleets emerged as the preferred pilots within the scale of A$20-A$100 million. These fleet arrangements score well because of the relative strengths of hydrogen technology in these applications, the large addressable market, and strategic objectives that can be achieved. From a performance perspective, the highest scoring opportunities offer high utilization of refueling infrastructure (e.g., back-to-base refueling models). This includes government fleets, bus corridors and logistics hubs. A case can also be made for pursuing material handling and haulage in the mining sector, but the procurement barriers will need to be considered closely. **We recommend that whole of life costing is undertaken** The capital cost of hydrogen technology is currently prohibitively high. The financial viability of the technology makes more sense when viewed from a whole-of-life perspective. Currently, however, the evidence base for this is limited. Buses, for example, have a thirty-year life and it is difficult to demonstrate the cost-effectiveness. We recommend that any pilot or trial decision considers estimates of operational and maintenance costing – these should be included in the commercial arrangement and the creation of a value proposition.

Recommendations

Key Suggestions	Description
Market Preferences	**We recommend that hydrogen use cases focus on a narrow set of industries and applications** Combustion engines and BEVs are likely to win the hearts and minds of consumers in the majority of transport applications. Furthermore, when compared to both these technologies, hydrogen has the most barriers relating to the cost-effective roll out of refueling infrastructure. For these reasons, hydrogen is likely to remain a relatively niche technology. Success will come from undertaking a narrow range of applications and doing them well. Focusing on fleet passenger transport, logistics activities and industrial sectors, such as mining, is seen as the preferred approach. **We recommend that trials are implemented in business-as-usual environments** The technology is relatively nascent – commercial entities, in particular, will be highly concerned with the operational performance of a hydrogen fleet and the whole of life costing (regardless of whether government assistance is provided for capital costs). Furthermore, trials will need to be publicly visible and well-integrated into a 'business as usual' setting in order to encourage broad adoption. **We recommend that trials need to be of a scale greater than A$5 million** In general, trials less than A$5 million do not have a large enough addressable market, or strategic impact to be considered effective. Investment within the A$20-A$100 million range allows for substantial-enough size of fleet. For example, a bus investment is not considered effective until it can support an end-to-end route.
Regulation & Policy	**We recommend that government looks beyond capital grants to support opportunities** A vertically integrated industry trial is preferable to enable the capital investment for refueling infrastructure to be distributed across multiple modes. This could occur within activities such as mining, logistics, urban transport or intra-city freight. From an industry perspective, however, the business case for the procurement of hydrogen FCEVs will need to be incentivized by government policy
Commercial Factors	**We recommend that pilots are partnered with industry stakeholders** This study found that successful trials are often achieved through a partnership of multiple stakeholders. A commercial model that is underpinned by a partnering arrangement (e.g., a manufacturer, end user, and refueling infrastructure provider), with appropriate risk apportionment between the different entities, will encourage best outcomes for initial trials.

Connect With Us!

eninrac is a leading provider of research, analytics and advisory services for your business nestled under different industry with unique insights to stakeholders across the globe. eninrac blends extensive knowledge of all aspects of your business industry to provide unmatched analytical insights, innovative strategies, and measurable value creation. We add value with pace, certainty and strategic agility and strive to exceed client expectations by delivering consistent results. We help our clients in unlocking potential and empowering organizations to achieve business objectives and goal effectively. We at eninrac put clients at the centre of our business and transform their risks into high rewarding opportunities through our innovative solutions.



Ravi Shekhar
Director & Head,
Research & Consulting,
Delhi-NCR Office,
Joy Tower, Block-C, Industrial Area, Sector 62, Noida -201 301
M: +91 93190 47693
E: rv@eninrac.com



Nitika Sharma
Vice President,
Corporate Strategy & New Business,
Delhi-NCR Office,
Joy Tower, Block-C, Industrial Area, Sector 62, Noida -201 301
M: +91 93190 48963
E: nsharma@eninrac.com

Contact:



Anurag Kumar Dubey
Senior Manager,
New Business,
Delhi-NCR Office,
Joy Tower, Block-C, Industrial Area, Sector 62, Noida -201 301
M: +91 72900 16953
E: akdubey@eninrac.com

RACeninrac

Truth is ever to be found in the simplicity, and not in the multiplicity and confusion of things

– Sir Isaac Newton

WRITE OR CALL TO US

at connect@eninrac.com / nsharma@eninrac.com

+91 9319048963 / +91 9319047963

NCR : 3rd floor, Joy Tower, C-20, 1/1A, C Block, Phase 2, Industrial Area, Sector 62, Noida, Uttar Pradesh - 201301

Copyright @ eninrac consulting private limited, 2023

powered by why

Accelerating Sustainability: Incentives Driving Change in the Automobile Sector

by

EY
Building a better working world

63rd ACMA Annual Session: 13th September 2023, New Delhi

Theme: 'Mobility 360° – Sustainability for Competitiveness

"Accelerating Sustainability: Incentives Driving Change in the Automobile Sector"

1. Introduction

In the dynamic landscape of India's economy, the automotive industry stands tall as a pivotal force, driving robust backward and forward linkages that propel the nation's growth trajectory. Its contribution to the National GDP has experienced a significant ascent. What once stood at a modest 2.77% in 1992-93 has grown to impressive 7.1% in FY 2021-2022.[1] Through strategic policy interventions, the industry has evolved into a vibrant and competitive marketplace, attracting new players and promoting substantial capacity growth. The industry has emerged as one of the largest manufacturing sectors in India, single-handedly contributing a substantial 49% share of the manufacturing GDP.[2]

The industry comprises of two major sub-sectors – The automobile industry (Original Equipment Manufacturers industry) and the auto components industry. India became the 3rd largest automobile market, surpassing Japan, and Germany in terms of sales, in December 2022.[3] The automobile market consists of four primary segments: passenger vehicles, commercial vehicles, two-wheelers and three-wheelers. Notably, India is currently the largest producer of 2-wheelers and 3-wheelers and 4th largest in 4-wheelers vehicle.[4]

The remarkable growth trajectory of India's automobile sector extends beyond domestic borders, with a remarkable 35.9% surge in exports in 2021-22. This is complemented by substantial Foreign direct investment worth $33.77 billion attracted between April 2000 and September 2022[5].

The narrative of the growth story in automobile sector takes an electrifying turn as the Indian Electric Vehicle (EV) ecosystem emerges. While EV is in its nascent phase in India, it has ignited optimism and excitement due to possible transformation into a cleaner future. Promoted by strategic investments and promotional initiatives, India's EV market is poised to flourish, with projections pointing toward an impressive annual sales figure surpassing 9 million units per year by 2027.[6]

EV industry has attracted investment worth ~USD 6 billion in 2021. This inflow of investments is a testament to the strong attention which EV market has attracted from private equity and venture capital investors in India. The industry has witnessed a remarkable growth trajectory in this regard, with investments increasing from US$ 181 million to US$ 1,718 million, recording an annual growth rate of 849%. Further, the same is expected to amplify to a staggering USD 20 billion investment by 2030.[7]

As the world intends to move towards a greener and more sustainable future, we believe that automotive sector will play a pivotal role in steering this transition. Infact India's current contribution of approximately 2.5 billion metric tons of carbon emissions, equivalent to about 7% of global emissions, underscores the imperative to adopt cleaner energy alternatives.[8] It is said that Internal

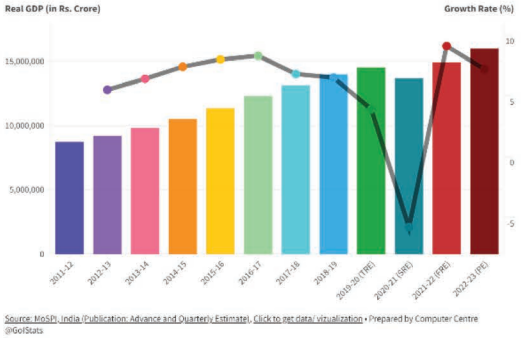
[1] https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/feb/doc2023217160601.pdf
[2] Ibid
[3] Economic Survey 2022-23, https://www.indiabudget.gov.in/economicsurvey/doc/eschapter/echap09.pdf
[4] Ibid
[5] https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/feb/doc2023217160601.pdf
[6] https://assets.ey.com/content/dam/ey-sites/ey-com/en_in/topics/automotive-and-transportation/2022/ey-electrifying-indian-mobility-report.pdf
[7] Ibid
[8] Ibid

Combustion Engine (ICE) vehicles are responsible for nearly 40% of the total pollution in India.[9] Further, amidst the rising fuel prices and mounting environmental concerns, electric vehicles have emerged as a promising solution. As India's automotive sector accelerates toward new horizons, it underscores the nation's commitment to innovation, sustainability, and progress.

2. Scaling Production Capacity Growth through Smart Policies and Incentives

India is one of the fastest growing economies of the world. India's economic growth before the COVID-19 pandemic can be seen by its rising trend of real GDP (refer Figure1). During the last decade, the real GDP only dipped once in FY 2020-21. This also had a major impact on India's manufacturing sector including the Automotive sector which has witnessed periods of robust growth and sharp degrowth. While the nation boasts of its skilled labour force and diverse industrial capabilities, it faces hurdles like financial and infrastructural limitations, bureaucratic red tape, and global competition. To overcome these challenges and strengthen its position globally, India initiated transformative measures that have reshaped its manufacturing landscape.

Figure 1

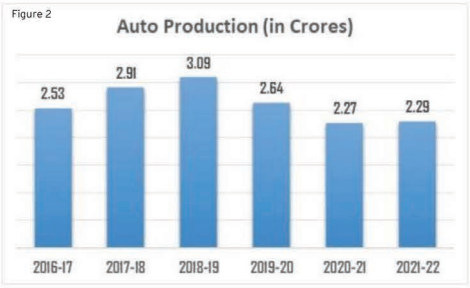


Source: MoSPI, India (Publication: Advance and Quarterly Estimate). Click to get data/ vizualization • Prepared by Computer Centre @GoIStats

The foundation of making India the global manufacturing powerhouse was laid down in 2014, when the "Make in India" campaign was started to promote domestic manufacturing and attract foreign direct investment (FDI) into the country. The goal was to improve the ease of doing business, simplifying regulations, and creating a favourable environment for both domestic and foreign companies to set up manufacturing units in India. This was further fuelled by the bigger idea of *Atmanirbhar Bharat Abhiyaan*, that emphasizes on reducing reliance on imports and boosting domestic production across sectors. It aimed at creating a self-sufficient and resilient economy that can withstand global challenges.

However, the COVID-19 had an adverse impact on the Automotive sector (refer figure 2). Thus, a need was felt of introducing a robust promotion plan to pace up the creation of economies of scale and overcome cost disabilities in global market. This required positioning India as a supply hub and create global champions in India, which required more governmental support. This paved the way for implementation of Production Linked Incentive Schemes for various sectors including Automobile sector and ACC battery storage to boost domestic manufacturing, enhance competitiveness and attract investments in the sector.

Figure 2



Source: THE AUTOMOBILE SECTOR IN INDIA, PIB, Ministry of Information and Broadcasting dated 17 February 2023

Concurrently, with the aim towards clean mobility, the Indian government has introduced several initiatives and policies for smooth transitioning towards alternate fuelled vehicles. Policies such as the National Automotive Policy and the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme were introduced in line with its goal to electrify 30 percent of the nation's fleet of vehicles by 2030[10]. These measures aim to support the automotive sector's growth, facilitate the adoption of advanced technologies, and align the industry with global sustainability goals.

[9] Ibid
[10] 'Aim to have 30% of 2030 car sales as EVs' - The Hindu

3. Decoding Schemes which are fuelling Automotive Manufacturing

Faster Adoption and Manufacturing of Electric Vehicles

The National Electric Mobility Mission Plan (NEMMP) 2020 was launched in 2013 and an ambitious target was set to be achieved by year 2020. The Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme was launched in 2015 to further the ambitious goal (set for NEMMP 2020) of achieving national fuel security by promoting hybrid and electric vehicles in the country. The scheme operates in multiple phases, each focusing on distinct objectives and outcomes.

FAME India Phase I

- This initial phase with a budgetary outlay of Rs. 895 crores ran until March 2019, and concentrated on four focus areas - technological development, demand generation, pilot project and charging infrastructure components.
- The scheme offered demand incentive to buyers of electric and hybrid vehicles (xEV) in the form of an upfront reduced purchase price to encourage wider adoption. Additionally, grants were sanctioned for specific initiatives including Pilot Projects, R&D/Technology Development, and establishment of Public Charging Infrastructure components under the scheme.

FAME India Phase II

- Drawing from the insights and knowledge gained from the implementation of Phase I of the FAME Scheme, and after incorporating valuable input from diverse stakeholders of industry associations, the approval for Phase II was granted with a substantial budget of Rs. 10,000 crores. This second phase spanned a duration of five years, commencing from April 01, 2019, indicating a continued commitment to encourage the growth of electric and hybrid vehicles in the country. Out of total budgetary support, about 86 percent of fund has been allocated for Demand Incentive so as to create demand for EVs in the country.
- With a greater emphasis on providing economical and environmentally sustainable solution, this phase was formulated with the core objective of supporting adoption of 7,000 Electric Buses (e-bus), 5 lakh Electric Three Wheelers (e-3W), 55,000 Electric Four-Wheeler Passenger Cars (including Strong Hybrid) (e-4W) and 10 lakh Electric Two Wheelers (e-2W). In addition, it was also proposed to support creation of a network of Charging Infrastructure in cities, particularly larger ones, those with over a million residents, smart cities, and hilly region.[11]
- Implementation of the FAME-II scheme was undertaken through – (i) providing incentives on demand for EVs, (ii) establishment of a network of charging stations, and (iii) publicity, administration of information, education on EVs, communication with stakeholders and similar awareness campaigns.
- However, recently in June 2023, a reduction in the quantum of incentives was announced, resulting in a tangible impact on the electric two-wheeler market. The demand incentive structure was adjusted and limited to INR 10,000/kWh which was earlier INR 15,000/kWh. The incentive cap has also been scaled down from 40% (before 1 June 2023) of the electric two wheeler's ex-factory price to 15%.
- This had resulted in price hikes of electric two-wheelers ranging from INR 10,000-30,000 which subsequently contributed to a more than 55% decline in sales from May to June 2023. According to the latest data from the Federation of Automobile Dealers Associations (FADA), electric two vehicles' sales went down from 1,04,829 units in May 2023 to 45,806 units in June 2023. According to a latest report by JMK Research, Ola took a 14% price hike and saw a month-on-month volume drop of 38% in June, Matter AERA took a 21% hike and saw a 69% drop, Ather

[11] AboutUs: National Automotive Board (NAB) (heavyindustries.gov.in)

450X took a 5% increase and saw 70% drop, TVS iQube 26% increase and 62% drop and Ampere took a 35% increase and 69% drop.[12]

Upcoming FAME India Phase III

- Considering the achievements made and challenges faced during the above two phases, the Government is now actively developing the third phase of the FAME scheme. This phase is expected to encompass a broader scope, potentially incorporating hydrogen-powered vehicles, extended support for electric three-wheelers and a revised version for two-wheelers[13].
- The government is contemplating a Rs 40,000-Rs 50,000 crore outlay for FAME-III[14]. Charging infrastructure is set to receive significant attention, with allocation doubling from the second phase.
- While the final details of FAME III are pending, it is anticipated that the Ministry of Heavy Industries will present the new policy for cabinet approval after consultations and inter-ministerial discussions before the end of this calendar year.

Production Linked Incentive

During the COVID-19 pandemic and resultant supply chain disruptions coupled with other external factors such as de-globalisation, trade wars between economic powerhouses, etc., the Government of India took several strategic steps to improve its economic condition. One notable initiative introduced in March 2020 was the Production Linked Incentive (PLI) schemes. PLI scheme is a scheme which is designed to provide incentives to manufacturing companies based on incremental sales from domestically manufactured products. While the scheme aims to create global champions, it encouraged companies to set up new or expand existing manufacturing units. The scheme further enabled cutting down the country's reliance on imports from other countries and generate employment for Indian population.

The initial phase of the PLI scheme, launched in March 2020, targeted three specific industries: electric components and mobile manufacturing, pharmaceutical (active pharmaceutical ingredients/critical key starting materials), and medical device manufacturing. Later, in November 2020, the Indian government unveiled the second phase of the PLI scheme, encompassing 10 key sectors including for Automobile & Auto Components and ACC battery storage. These PLI schemes were designed and released with the intention of beating the cost disability, achieving economies of scales in domestic manufacturing, accompanied by import substitution and employment generation.

Over time, a total of 14 different schemes have been introduced by the Government, offering turnover linked incentives to approved investors, upon meeting the specified investment, capacity, and turnover criteria. Due to their straightforward structure and potential advantages, these schemes gained rapid popularity among businesses. The government has been actively launching new schemes and finalizing others, showcasing swift progress in this domain. The key objectives and status of PLI scheme for the automobile sector are summarised below for reference:

Production Linked Incentive (PLI) Scheme for Automobile & Auto Components

- On September 15, 2021, the Union Cabinet, led by the Prime Minister Shri Narendra Modi, approved the Production-Linked Incentive (PLI) Scheme for Automobile and Auto Components sectors. The objective of the PLI, as briefly highlighted above, was to overcome cost disabilities, create economies of scale, and building a robust supply chain in the components related to Advanced Automotive Technology.

[12] Fame-II Subsidy: Fame-ii Subsidy: June E-2-wheeler Sales Crash | Chennai News - Times of India (indiatimes.com)
[13] Electric Vehicles: FAME III in the works, may cover alternative fuel vehicles this time - The Economic Times (indiatimes.com)
[14] India plans up to Rs 50,000 crore outlay to subsidise more EVs under FAME-III scheme (cnbctv18.com)

- The salient features of the scheme have been captured below[15]:
    - **Coverage:** The scheme is divided in two sections viz. Champion OEM Incentive Scheme (for Advanced Automotive Technology vehicles) and Component Champion Incentive Scheme (preapproved Advanced Automotive Technology components).
    - **Eligibility (Minimum Revenue):** Global group revenue from automotive and/or auto component manufacturing shall be at least Rs. 10,000 crores (for Auto OEM) and Rs. 500 crores (for Auto Components)
    - **Eligibility (Minimum Investment):** Global Investment of the company or its group in gross block of Rs. 3000 crore (for Auto OEM) and Rs. 150 crores (for Auto Components)
    - Separate eligibility criteria for new non-automotive investor companies or group companies.
    - Year on Year (YoY) growth of a minimum of 10% in Determined Sales Value of first year i.e., Rs.125 crore must be achieved by all approved Auto OEM companies; and Rs.25 crore must be achieved by all approved Auto OEM component companies to become eligible to receive incentive.
    - **Incentive for Auto OEM:** 13%-18% on net incremental sales of eligible products over base year; and **Incentive for Auto components:** 8%-13% on net incremental sales of eligible products over the base year

      Further, if cumulative determined sales value exceeds of Rs. 1,250 Crores over 5 years, additional 2% incentives would be provided on the incremental sale in excess of Rs. 1,250 Crores.

      Additional 5% incentive for specified components of battery electric vehicle and hydrogen fuel cell vehicles
- The scheme attracted a total of 115 applications among which, a total of 85 applicants were approved. Among the approved applicants, 18 fall under the Champion OEM Incentive scheme, while 67 have been accepted under the Component Champion Incentive scheme. Interestingly, two automotive Original Equipment Manufacturers (OEM) have been granted approval for both segments of the scheme. This initiative has proven to be successful in attracting a proposed investment of ₹67,690 crore, surpassing the initial target of ₹42,500 crore over a span of five years.[16]

Production Linked Incentive (PLI) Scheme 'National Programme on Advanced Chemistry Cell (ACC) Battery Storage'

- Complementing the PLI for Automobile & Auto Components, Ministry of Heavy Industry introduced another PLI for 'National Programme on Advanced Chemistry Cell (ACC) Battery Storage'. While FAME scheme focused on demand generation and charging infrastructure creation, PLI scheme for ACC battery Storage was aimed toward incentivising and localising the highest cost contributor of around 45-50% in an electric vehicle i.e., Batteries.
- The Government has approved the PLI Scheme for 'National Programme on Advanced Chemistry Cell (ACC) Battery Storage' for achieving manufacturing capacity of Fifty (50) Giga Watt Hour (GWh) of ACC and an additional cumulative capacity of 5 GWh for niche ACC Technologies for Enhancing India's Manufacturing Capabilities with a budgetary outlay of ₹18,100 crore.

[15] pliauto.in/docs/guidelines/Notification.pdf
[16] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1887129

- Further, to promote the ecosystem of ACC battery in India, PMP programme has been formulated for ACC Battery components. In reference to the same, PMP programme prepared by Niti Aayog is as follows:

PROPOSED BASIC CUSTOM DUTY MATRIX (2021-30):
PMP WITH INTENT TO PROMOTE MAXIMUM DOMESTIC VALUE CAPTURE

NITI Aayog

Phasing of Basic Customs Duty

	Goods	2020–2022	2022–2023	2023–2025	2025–2027	2027–2031	2031 & beyond
1a	ACC batteries or battery including EV batteries, except for 1b and 1c	5%	15%				
1b	Lithium-ion batteries of cellular mobile phones	15%					
1c	ACCs and batteries used to manufacture goods under chapter 8471 of the custom tariff heading	0%					
2	ACCs (such as lithium-ion cells) for manufacture of battery packs	5%	10%	10%	10%	10%	10%
3	Parts such as anode, cathode, electrolytes, and separators required to manufacture ACCs	2.5%	2.5%	5%	10%	10%	10%
4	Goods (processed and unprocessed) required to manufacture parts of ACCs, such as graphite, cobalt, lithium, nickel, except for copper and any other product that is announced	2.5%					
5	Plant and machinery required to set up a plant for manufacturing ACCs	0%	0%	0%	5%		7.5%

- The Ministry of Heavy Industries (MHI) had released a Request for Proposal (RFP) for this program on October 22, 2021. A total of 10 companies have submitted their bids for the Advanced Chemistry Cell (ACC) Battery Storage Programme in India Out of these, three approved companies participating in the scheme have signed the Programme Agreement. Their aim is to carry out the PLI ACC programme, which involves establishing manufacturing facilities capable of producing 30 GWh of ACC capacity.[17]
- This program has been carefully crafted to be open to various technologies. Companies benefiting from the scheme have the freedom to select the most suitable advanced technology, along with the necessary plant and machinery, raw materials, and other components needed for establishing a cell manufacturing facility. This facility can cater to different applications.
- The main goal of the government through this initiative is two-fold. First, there's a strong emphasis on increasing the domestic value addition, ensuring that a significant portion of the manufacturing process happens within India. Second, the program aims to maintain a globally competitive levelized cost for battery manufacturing in India. In simple terms, the government wants to ensure that the cost of producing batteries in India remains competitive on the international stage.

The above visionary schemes, spanning multiple phases and sectors, underscore a commitment to promote sustainable mobility solutions while focusing on local manufacturing, generating employment, and reducing import dependency. These PLIs have poised to be instrumental in lowering overall vehicle cost and reducing import dependency. Resultantly, the scheme is pushing for the EV penetration while developing the ecosystem for EV-specific components. Having said that, it is important to mention that various challenges were faced during implementations, threshold fulfilments etc., which need due action for achieving the required preparedness for the brighter future.

[17] pib.gov.in/PressReleaseIframePage.aspx?PRID=1887129

4. Empowering Automobile sector through State Incentives

In India's democratic system, effective collaboration between the Central and State governments is the key for the success of policies and plans. As you are aware that the Government of India has set ambitious goals for advancing electric mobility across the country. However, the practical implementation of these policies and programs rests with state governments and local authorities. These regional bodies not only carry out the directives and schemes from the Central Government, but some have also taken additional measures to independently promote electric mobility, recognizing the economic and industrial potential in this emerging sector.

While an EV policy isn't a mandatory prerequisite for State-level action, its existence reflects a State Government's dedication to foster e-mobility. Such a policy provides a comprehensive approach to encourage and support various facets of the EV ecosystem within the State.

Presently, 26 States have introduced their own unique EV policies. These State-level initiatives encompass a range of incentives, including subsidies for capital investments in both infrastructure and land. Additionally, they feature numerous demand-side incentives such as incentives for parking, road tax exemptions, and various tax-related benefits. Some States have even established specialized EV zones and have taken steps to promote the growth of EV start-ups by setting up venture capital and business incubation services.

The salient features of the few of the State incentive schemes has been tabulated below:

Sr. No.	State	Policy	Key Incentives
1.	Haryana	Haryana Electric Vehicle Policy 2022[18]	**For Manufacturers:** **Capital Subsidy:** 10-25% of fixed capital investment depending upon investment quantum. Companies setting up batteries' disposal units will get 15% of FCI up to INR 1 crore. **Net SGST Reimbursement:** The SGST reimbursement shall be 50% of the applicable Net SGST for a period of 10 years. **Brownfield incentive:** The policy extends one-time support to existing manufacturers transitioning their operations to focus solely on EV manufacturing. Eligible units falling within the micro, small, medium, and large categories can benefit from financial assistance amounting to 25% of the book value, up to INR 2 crore. **Stamp Duty Reimbursement and Electricity Duty Exemption:** The policy grants a full 100% reimbursement of stamp duty expenses for land, buildings, etc., intended for EV manufacturing. Additionally, there is a generous exemption from electricity duty for a substantial period of two decades. **For Buyers** The policy will provide early bird direct benefit transfer from 15-50% of ex-showroom price and up to a maximum

[18] https://investharyana.in/content/pdfs/EV%20Policy%202022.pdf

			of INR 10 Lakh on purchase of EC or Hybrid EV in the State.
2.	Rajasthan	Rajasthan Electric Vehicle Policy 2022[19]	Exemption from Motor Vehicle Tax and Green Tax payable under the Rajasthan Motor Vehicle Taxation Act 1951 Exemption from the requirement of permit for carrying passengers or goods SGST reimbursement to all categories of EVs Upfront Incentives as per battery capacity: 2W- Fixed Battery: from INR 5,000-10,000 Swappable Battery: from INR 2,000-5,000 3W- Fixed Battery: from INR 10,000-20,000 Swappable Battery: from INR 4,000-10,000 15% of the retrofit kit cost (including taxes) up to INR 10,000 per vehicle 4W- From INR 30,000-50,000 provided maximum Ex-showroom price to avail this incentive is INR 20 lakhs 15% of the retrofit kit cost (including taxes) up to INR 15,000 per vehicle
3.	Tamil Nadu	Tamil Nadu Electric Vehicles Policy 2023 [20]	**For manufacturers -** 100% Gross SGST reimbursement or Turnover based subsidy is up to 2% of the project's annual turnover, subject to an annual cap of 4% of the cumulative investment for a period of 10 years from the date of commercial production. The same shall be scaled as per the project's employment commitment. or Capital Subsidy of 15% of Investment over 10 years. Other incentives include electricity duty exemption for 5 years, stamp duty exemption, reimbursement of employer's contribution to EPF for 1 year subject to maximum Rs. 48000 per employee, Green Industrial Incentive up to Rs. 1 Cr as per TN Industrial Policy 2021, subsidy of 50% of cost incorrect on quality certifications, 50% reimbursement of cost incurred on intellectual property creation and training subsidy of Rs. 4000-Rs.6000 (depending upon employee) per employee per month for 6 months for 10% for existing workforce. **For Buyers (till 31.12.2025)** Commercial e-2W/3W/4W will be provided incentive of Rs.10,000/Kwh with an upper cap on incentive as well as number of vehicles to be incentive. Private EVs will be provided 100% road tax exemption, waiver on Registration charges/fees and waiver on Permit Fees

[19] https://istart.rajasthan.gov.in/public/pdf/REVP_2022.pdf
[20] https://investingintamilnadu.com/DIGIGOV/StaticAttachment?AttachmentFileName=/pdf/poli_noti/TN_Electric_Vehicles_Policy_2023.pdf

			Subsidy of 25% on cost of Plant and machinery to setup charging station (maximum Rs. 10 lakhs for Fast Charging Station and Rs.1 lakh for slow charging station) and battery swapping station (maximum up to Rs 2 lakhs)
4.	Uttar Pradesh	Uttar Pradesh Electric Vehicle Manufacturing and Mobility Policy 2022[21]	**For Manufacturers** Capital subsidy up to 30% of fixed capital investment for EV and battery projects Reimbursement of 100% Stamp duty, 50% Quality certificate charges, 75% patent registration fee, Rs. 5000 as stipend per employee. **For Buyers** 100% exemption from Registration Fees & Road Tax for EV purchased & registered in UP over a period of 3years from policy notification and EV manufactured, purchased & registered in UP in the 4th & 5th year of policy period. One time purchase subsidy (subject to budgetary outlay and number of vehicles in each category) a) 2-Wheeler EV: @15% of ex-factory cost up to Rs 5000 b) 3-Wheeler EV: @15% of ex-factory cost up to Rs 12000 c) 4-Wheeler EV: @15% of ex-factory cost up to Rs 1 lakh d) E-Buses (Non-Govt, i.e., School buses, ambulances, etc.): @15% of ex-factory cost up to Rs 20 lakh e) E-Goods Carriers: @10% of ex-factory cost up to Rs 1,00,000

5. Status report of the above Schemes

The above discussed schemes undoubtedly have had a significant impact on the automobile industry, especially the EV market in India. The achievements of these schemes and policies are a testament to the government's commitment to promoting sustainable mobility. Few of the major achievements under these schemes are as follows:

Faster Adoption and Manufacturing of Electric Vehicles (FAME)

FAME Scheme has helped in boosting the adoption of electric vehicles (EVs), particularly in the e-2 wheeler. During Phase 1 and Phase 2, FAME achieved significant milestones, which have laid the foundation for a sustainable EV ecosystem and have contributed to the ongoing shift towards cleaner and greener mobility solutions. Some of these milestones are listed below:

- **FAME India – Phase 1[22] :**
  - About 2.8 lakh xEVs supported with total demand incentives of approximately Rs. 360 Crore.
  - 425 electric and hybrid buses were deployed across various cities in the country with Government incentive of about Rs. 280 crores.
  - 520 Charging Stations/ Infrastructure for Rs. 43 crores (approx.) were sanctioned.

[21] https://invest.up.gov.in/wp-content/uploads/2022/11/UP-EV-Policy-2022-V10-Final.pdf
[22] doc202271169601.pdf (pib.gov.in)

- **FAME India – Phase II[23] (till February 2022) includes:**
  - 4,69,315 Electric Vehicles supported by way of Demand Incentive amounting to about Rs. 1869 crores
  - 6315 e-buses sanctioned to 65 cities/STUs/CTUs/ State Govt. entities for intracity and intercity operations across 26 states/UT under the Scheme
  - 2877 charging stations sanctioned in 68 cities across 25 states/UTs
  - 50 Original Equipment Manufacturers (OEMs), both start-up and established manufacturers, registered and revalidated their 106 electric vehicle models
  - Sale of electric two wheelers vehicles increased manifold

- The total claim incentive approved under the FAME in 2022 (Jan-Dec 2022) is Rs. 1868.56 crore for which segment wise breakup is provided below[24] :

Sl. No.	Segment	Total Claim Incentive Approved in 2022 (Jan-Dec 2022)
1	e-2w	Rs. 1280.07 Cr.
2	e-3w	Rs. 168.93 Cr.
3	e-4w	Rs. 55.17 Cr.
4	e-buses	Rs. 364.39 Cr.
	Total	**Rs. 1868.56 Cr.**

Production Linked Incentive (PLI) Scheme for Automobile & Auto Components

- PLI for Automobile sector posed to be a successful achievement is pushing the manufacturing momentum.
- The scheme was successful in attracting proposed investment of ₹67,690 crore, surpassing the initial target estimate of ₹ 42,500 crore over a period of five years during the initial application phase. [25]
- Major players like Mahindra & Mahindra Limited (M&M Ltd.), have committed to make investments of around Rs. 10,000 Crore over a period of 7-8 years for setting up the manufacturing facility, development, and production of Mahindra's upcoming Electric Vehicles in Pune city[26]. It has also announced a dedicated platform in the United States in order to assist US companies to manufacture in India[27]. This being said, M&M Ltd. has emerged as the market leader in the automobile space. It has also become the first firm to receive the eligibility certificate under the Rs. 25,938-crore production-linked incentive scheme for automobiles (auto PLI), thereby opening the door to receiving subsidies[28].
- Bengaluru-based Toyota Kirloskar Auto Parts (TKAP) has also expanded its horizons by exporting the e-Drive (a key part of the electrified powertrain) to Japan, in addition to markets such as Indonesia and Thailand. The e-Drive is an advanced automotive technology used in hybrid electric vehicles (HEVs) such as Toyota Urban Cruiser Hyryder and Toyota Innova Hycross, as well as in Maruti Suzuki Grand Vitara, which Toyota Kirloskar Motor (TKM) manufactures for Maruti Suzuki, under the Toyota-Suzuki global tie-up.[29]
- Numerous foreign enterprises are also eyeing investments in India to tap into the potential of the EV sector. Taiwanese company Foxconn is exploring the possibility of producing small battery-operated cars in India.

[23] doc202271169601.pdf (pib.gov.in)
[24] https://pib.gov.in/PressReleasePage.aspx?PRID=1946360
[25] pib.gov.in/PressReleaseIframePage.aspx?PRID=1887129
[26] Mahindra to locate EV Manufacturing Plant in Pune, Maharashtra

[27] Stellantis, Samsung SDI to build second Gigafactory in the USA | Autocar Professional
[28] In a first: Mahindra & Mahindra receives PLI eligibility certificate (business-standard.com)
[29] Toyota India starts exporting EV components to Japan | The Financial Express

Production Linked Incentive (PLI) Scheme 'National Programme on Advanced Chemistry Cell (ACC) Battery Storage'

- PLI for ACC battery storage has the potential to strategically boost the entire supply chain of the EV ecosystem.
- Total investment envisaged under the scheme is around Rs 27,000 crore.
- Net saving of Rs. 2,00,000 Crore to 2,50,000 crore on account of oil import bill reduction due to EV Adoption.
- Total 2.7 lakh direct and indirect employment expected to be generated.

State EV Policies

Just as the implementation of the aforementioned scheme has drawn substantial investments at the central level, the momentum provided by strategic state policies has been pivotal in propelling the sector towards expansion and development. Industry has shown significant interest in applying for these policies which can be clearly seen by a range of following examples:

a) Hyundai Motor India (HMIL) signed an agreement with Tamil Nadu to invest around Rs 20,000 crore over a span of 10 years for expanding electric vehicle (EV) production and its associated ecosystem.[30]
b) Tamil Nadu government signed a Memorandum of Understanding (MoU) with Ola Electric Mobility Pvt. Ltd., with an investment potential of ₹7,614 crore for setting up world's largest EV hub with integrated two-wheeler, car, and lithium cell giga factories[31]
c) Tamil Nadu sets sights on being EV capital as 68% of all EV two wheelers sold in India are manufactured in Tamil Nadu[32]
d) Maharashtra signs MoU worth ₹2,823 crore to manufacture electric vehicles[33]
e) Tata Motors signs MoU with Maharashtra to set up vehicle scrapping facility with a capacity of recycling up to 35,000 vehicles a year[34]
f) HOP Electric Mobility signs MoU with Rajasthan govt to expand capacity from producing 7,500 units/month to 15,000 units/months.[35]

These are just few of the examples among many other such commitments from many different players making their bit of contribution towards the EV penetration mission.

6. Challenges faced within Automotive Sectors

Amidst these vigorous efforts to boost manufacturing capacity, it is important to mention that the journey of these schemes had seen bumpy roads. As you are aware that every plan/policy has some shortcomings, and it is these shortcomings which prompts the policy makers to devising more detailed and structural plans to mitigate these challenges. However, the foundation step in this process is identification of these challenges. Few of the identified challenges which have been raised/faced by various stakeholders are summarized below:

[30] Hyundai signs deal with Tamil Nadu for Rs 20,000 cr investment in EV space (business-standard.com)
[31] Ola signs MoU with T.N. to set up 'world's biggest' EV hub - The Hindu
[32] https://economictimes.indiatimes.com/tech/technology/68-of-all-ev-two-wheelers-are-manufactured-in-tamil-nadu-trb-rajaa/articleshow/102863626.cms?from=mdr
[33] Maharashtra signs MoU worth ₹2,823 crore to manufacture electric vehicles | Mumbai news - Hindustan Times
[34] Tata Motors signs MoU with Maharashtra to set up vehicle scrapping facility - The Hindu BusinessLine
[35] https://auto.economictimes.indiatimes.com/news/two-wheelers/scooters-mopeds/hop-electric-mobility-signs-mou-with-rajasthan-govt-to-expand-capacity/88457866

FAME

- In the recent 18 month, MHI received complaints against 17 OEMs under the FAME regarding PMP compliance & manipulation of Ex-factory price. Accordingly, disbursements were put on hold and matter were referred to testing agency for verification. [36]Post examination, 7 OEMs were found to be violating the PMP norms and were issued notices, whereas 4 OEM agreed to refund Rs. 322.11 Cr. to customers for breaching Ex-factory price norms. 6 OEMs were found PMP compliant.[37]
- However, many representations are filed from the industrial players mentioning the difficulties/challenges faced by them, such as:
    - Meeting the stringent eligibility conditions of the Domestic value addition (DVA) criteria which is linked to the ex-factory price under FAME. It is argued that DVA is being calculated at ex-factory price (which in general is less than the cost price of vehicle as EV are being sold at loss) after deducting the import value. Realistically, the effective DVA is less than the actual localization as the formula deducts import value from the ex-factory price. Therefore, pleas have been made by various players that DVA formula should allow loss as a part of the DVA computation i.e., in other words the formula should work on ex-factory price or cost of goods manufactured at factory gate, whichever is higher – thereby reflecting the correct locale value addition.
    - The FAME subsidy is available for vehicles having ex-factory price of upto INR 1,50,000; and as mentioned above ex-factory price INR 1,50,000 is not enough to cover the cost price of the EVs. This price limit of INR 1,50,000 is determined as per the rates applicable in year 2016, and the same should be revised to adjust to foreign exchange fluctuation and cell prices.

Automobile and Auto Component PLI

- FAME does not provide direct subsidy to the manufacturer rather it provides subsidies to the end customers. Accordingly, the manufacturers were eyeing towards the PLI scheme for optimising their cost.
- However, due to high slab of existing net worth, investment commitment and revenue requirements, start-ups couldn't avail the benefit and only handful of players could apply.
- Further, the Standard operating procedure for the said PLI was issued recently in Apr' 23 due to which the many companies have expressed their inability to get the product tested, undertake required investment, and claim the benefits for FY23. Hence, companies are requesting extension of the scheme period by 1 year (both for investment and incentive disbursal).
- Further, it is observed that meeting the DVA criteria is challenging for applicants under Auto PLI similar to applicants under FAME as mentioned above. Thus, representations are being filed asking for introduction of PLI 2.0 with graded 5-year investment slab and realistic eligibility criteria.

ACC Battery Storage PLI[38]

- Regarding ACC battery as well, the eligibility condition of the net-worth criteria is too high and also does not allow net worth of promoters to be added for the purpose of determining the net worth for eligibility barring many applicants to get eligible. Thereby barring start-ups, unicorns having access to advanced technology to participate in the scheme.

[36] Ibid
[37] ibid
[38] pib.gov.in/PressReleaseIframePage.aspx?PRID=1887129

- Further, stringent time period for setting up the facility (2 years) and meeting the value addition criteria (60% in 5 years) makes it difficult for players to sustain, given long gestation period of >2 years for setting up of factory and unavailability of raw material in India. Therefore, industry is looking forward towards seeing certain modification in 60% DVA criteria.

- The Government is under discussion with stakeholders for fresh bids to fill the remaining slot. In this regard, industry is expecting that the eligibility criteria for new/revised ACC PLI scheme should be aligned in a manner to allow start-ups & new entrepreneurs (i.e., net worth criteria should be reduced and should also allow net worth of promoters to be added for the purpose of determining the net worth for eligibility) and should give weightage to technology developed by Indian promotors.

State EV Polices

- Though the presence of EV policies in a majority of Indian states is a positive indicator. Yet, the accomplishment of a seamless shift towards zero-emission mobility is hindered in their formulation and execution.

- As per a report by Climate Trends titled "Analysis of State Electric Vehicle Policies and their impact" where various State EV polices were assessed on 21 parameters, it was concluded that none of the Indian states are on track to meet their EV targets[39].

- Madhya Pradesh aims for 25% of all new registered vehicles to be electric by 2026, but its current EV penetration stands at 2.2% (as of December 2022) of total vehicle sales since policy launch. Similarly, Delhi aims for 25% of all new registered vehicles to be electric by 2024. Although the city has the highest number of EVs in the country, its penetration is still only 7.2% of total registered vehicles (as of December 2022)[40].

While challenges have emerged, like the recent adjustments in incentives impacting the electric two-wheeler market, delay in issuance of SOP under Automobile and Auto Component PLI and relatively difficult eligibility threshold under ACC PLI scheme, despite such challenges, these initiatives have demonstrated their effectiveness in attracting investments, driving innovation, and accelerating the adoption of advanced automotive technologies. However to achieve the desired targets not just at the respective state levels and national level but also at a global level, the need of the hour is to address the challenges faced and revise the policies as required.

7. Adopting Global best practices

Globally many countries have adopted EV as an environmentally sustainable solution and are also adopting state of the art technologies to facilitate clean mobility. The largest sales figures of EV penetration were seen in China. China and Europe combined contributed over 85% of global electric car sales in 2021. The United States followed with 10% of the market share.[41] Considering this, India is currently at a budding state as the EV penetration rate (EV sales as a percentage of total light vehicle sales, including passenger vehicles and light commercial vehicles) in India in CY 2022 was at 1.1 per cent, as compared to the Asian average of 17.3 per cent[42].

[39] https://economictimes.indiatimes.com/industry/renewables/none-of-the-indian-states-are-on-track-to-meet-their-ev-targets-study/articleshow/98000864.cms?from=mdr ; https://climatetrends.in/wp-content/uploads/2023/02/full-report-digital-with-spreads.pdf

[40] https://climatetrends.in/wp-content/uploads/2023/02/full-report-digital-with-spreads.pdf

[41] https://iea.blob.core.windows.net/assets/e0d2081d-487d-4818-8c59-69b638969f9e/GlobalElectricVehicleOutlook2022.pdf

[42] https://www.business-standard.com/economy/news/ev-penetration-at-1-1-india-is-far-behind-asian-average-of-17-3-123051701196_1.html

At this juncture, it is important to highlight the growing demands in electric two wheelers. The two-wheeler market is projected to achieve a compound annual growth rate of 8.7 percent through 2029 and is expected to reach a value of approximately $218 billion.[43]

As per the analysis carried out by McKinsey & Company, developed geographies and China are already moving to electric two-wheelers.[44]This can be observed vide the following data:

Electric-2-wheeler facts and product mix, by geoography,[1] unit of measure

	China	ASEAN[4]	North America and Europe	India	Other South Asia	Latin America	Africa
2021 market size,[1] million units	~15.0	~12.0	2.1	15.1	2.3	~2.8	~1.0
Estimated CAGR 2021–30, %	0–1	4–5	5–6	6–7	5–6	5–6	12–14
Moped/ Bebek,[2] %	–	15–20	–	3–4	0–5	15–20	0–5
Scooter, %	80–85	70–75	25–30	28–30	25–30	0–1	0–1
Light motorcycle, %	0–5	5–10	10–15	60–65	65–70	70–75	90–95
Heavy motorcycle,[3] %	0–5	0–5	50–60	4–5	0–5	0–5	0–5
Electrification level, %	~15	~2	~8	~4	<1	<1	<1

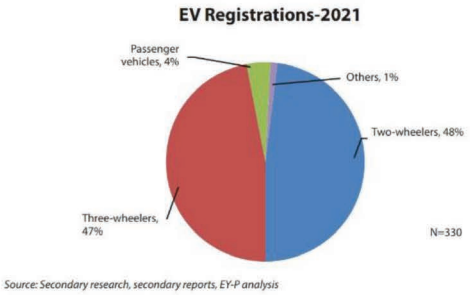
[1]The e-bike market (maximum speed of <25 kilometers per hour) has been excluded from the scope, due to the dominance of Chinese players in this segment playing at low cost.
[2]A bebek is a small-capacity two-wheeler popular in Indonesia.
[3]A motorcycle >250 cubic capacity.
[4]Association of Southeast Asian Nations.
Source: ASEAN Automotive Federation; Freedonia; Frost & Sullivan; Federation of Asian Motorcycle Industries; Society of Indian Automobile Manufacturers; McKinsey analysis

McKinsey & Company

The success of electric two-wheelers is already evident in developed countries and China, where government support has driven higher EV adoption rates. Sales of the electric bikes in the US have grown more than eight-fold since 2014 and is forecasts to sell a total of 113 million e-bikes between 2020-2023[45]

[43] https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/the-real-global-ev-buzz-comes-on-two-wheels
[44] Ibid
[45] https://auto.economictimes.indiatimes.com/news/two-wheelers/scooters-mopeds/e-bikes-to-rule-the-us-ev-market-in-next-decade/72828463

Further, considering India's success story in electric-2 wheelers, in 2021, EV registrations amounted to ~330k units, a jump of 168% from 2020 which was led by two -wheelers with ~48% share. (Refer pie-chart)[46].



Source: Secondary research, secondary reports, EY-P analysis

Therefore, it is undeniable that the electric two-wheeler market presents a significant opportunity for driving EV penetration, especially in regions where these vehicles are a substantial part of the transportation network. To accelerate the transition to electric mobility, governments should focus on incentivizing the electric two-wheeler sector.

However, many start-ups, who have entered the automobile sector by introducing electric two-wheelers are currently expressing their difficulties in achieving targets and increasing production capacity. One of the reasons for this is net-worth/investment eligibility threshold which bars many of these start-ups to get eligible for the incentives provided at central and state level schemes.

By lowering these barriers, start-ups that have entered the electric two-wheeler industry but haven't yet achieved economies of scale can benefit from the schemes, fostering innovation and competition in the market. Additionally, policies that encourage research and development, as well as partnerships between OEMs and other relevant industries, can further accelerate the growth of the electric two-wheeler market.

Overall, the success of electric two-wheelers in driving EV penetration relies on a combination of targeted incentives, supportive policies, and a focus on addressing the unique needs of the market. By adopting these strategies, governments can help achieve their EV penetration goals while promoting a cleaner and more sustainable mode of transportation.

Speaking of cleaner and sustainable mode of transportation, it is imperative to understand that though building a manufacturing ecosystem is the need of the hour, a commitment towards environmental sustainability deserves equal attention. Keeping this in mind, the government has taken various steps towards safeguarding the environment while accelerating towards development.

8. Electrifying Tomorrow: Government Policies Shaping the Future of clean mobility

The government's keen dedication towards safeguarding the environment while accelerating towards development is evident through persistent measures taken towards curbing environmental degradation. The sustainable practices and technologies include research linked incentives, incorporating green credit, extended producer responsibilities, green financing, carbon credits, circular economy and ESG standards. Some of the key such measures are discussed below:

Research Linked Incentives

- An integral part of this movement is the recognition of the paramount role Research and Development (R&D) plays. It not only forms the foundation for generating value-added growth and promoting innovation but also stands tall for innovative solutions that prioritize environmental protection. Drawing inspiration from the success of existing Production-Linked Incentive (PLI) schemes, the Government of India is poised to introduce Research Linked Incentives (RLIs) across major sectors. This strategic move aims to catalyse R&D investments and channel innovation towards harmonizing development with environmental preservation.
- Beyond this, the government's comprehensive approach extends to incentivizing Common Effluent Treatment Plants and other innovative measures. These well-rounded steps highlight a strong promise to make sure that our progress and success is achieved through sustainable

[46] https://assets.ey.com/content/dam/ey-sites/ey-com/en_in/topics/automotive-and-transportation/2022/ey-electrifying-indian-mobility-report.pdf

measures. This involves incentivizing eco-friendly practices, proper disposal and recycling, funding sustainability projects, offsetting emissions, minimizing waste, and ensuring transparency.

Green Credit

- 'Green Credits' are singular units of an incentives provided for specified activity that delivers a positive impact on the environment such as tree plantation, water conservation, sustainable agriculture waste management, air pollution reduction etc. In this regard, draft rules have been notified in June 2023 for the Green Credit Programme.
- Though the programme is currently in its early stages of development, it is expected to be launched in a phased manner; and has the potential to be a game-changer in India's efforts to combat climate change and promote sustainable development.

Carbon Credit

- Similarly, Carbon Credit Trading Scheme (CCTS) is notified by Ministry of Power[47]. A carbon credit is a tradable certificate or permit representing the right to emit one tonne of carbon dioxide (CO2) or the equivalent amount of other greenhouse gases. Carbon credits are created when a company or organization reduces its greenhouse gas emissions or removes greenhouse gases from the atmosphere.
- Currently, India is a major player in the global carbon credit market, having issued over 35.94 million carbon credits or nearly 17% of all voluntary carbon market credits issued globally since 2010[48]. The majority of these credits have been sold on the voluntary market, but there is growing interest in the development of a mandatory carbon market in India. Therefore, the government is expected to launch a mandatory carbon market in India in near future. The development of a mandatory carbon market will also help to boost investment in low-carbon technologies and projects.

Battery Swapping Policy

- The Indian government is also introducing a Battery Swapping Policy to standardize EV battery specifications across the country.[49] This policy is particularly beneficial for time-sensitive services like deliveries and inter-city transportation, where swapping drained batteries for fully charged ones is more practical than waiting for recharging. This move will ensure battery interoperability and faster adoption of electric vehicles, especially in commercial segments like 2-wheelers and 3-wheelers.

Special E-mobility Zone

- To promote electric mobility, the government plans to create Special E-mobility Zones where only electric vehicles or comparable alternatives will be allowed to operate. These zones will not only encourage electric vehicle adoption but also help reduce traffic congestion by limiting private vehicle access.

Vehicle Scrappage Policy

- The Vehicle Scrappage Policy is a government-funded initiative aimed at phasing out old and polluting vehicles from Indian roads. Starting from April 1, 2023, fitness testing for Heavy Commercial Vehicles (HCVs) will be exclusively conducted through Automated Testing Stations (ATSs). For other Commercial Vehicles (CVs) and Private Vehicles (PVs), fitness testing through ATSs will begin on June 1, 2024. Vehicles older than 15 years for commercial vehicles and 20

[47] 246859.pdf (egazette.gov.in)
[48] https://www.ciiblog.in/indian-carbon-credit-market/
[49] https://pib.gov.in/PressReleasePage.aspx?PRID=1818569

years for private vehicles will be scrapped if they fail the fitness test, resulting in them being classified as End-of-Life Vehicles (ELVs). The policy aims to reduce the carbon footprint and promote the use of newer and cleaner vehicles. [50]

9. Conclusion

India's automotive sector has undergone a remarkable transformation, fuelled by a commitment to sustainability and innovation. The industry's substantial contribution to the national GDP and employment underscores its significance in the country's economic growth. Key policy interventions and incentives, such as the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme and Production Linked Incentive (PLI) programs, have been instrumental in driving growth, attracting investments, and fostering technological advancements. These incentives have led to a surge in electric vehicle adoption, the expansion of manufacturing capabilities, and a tangible reduction in carbon emissions.

The collaborative approach between the central and state governments has further propelled the shift toward sustainable mobility. State-level incentives and region-specific policies have complemented national efforts, creating a synergistic ecosystem that supports electric vehicle adoption and charging infrastructure development. This inter-Governmental collaboration highlights the importance of a unified approach to achieve both economic prosperity and environmental sustainability.

The Government continues to demonstrate its commitment to sustainability through initiatives like research-linked incentives, green credit programs, and forward-thinking policies such as battery swapping, and vehicle scrappage. These comprehensive measures underscore the nation's dedication to addressing environmental challenges while driving economic growth. Ultimately, the trajectory of India's automotive industry showcases a dynamic shift toward a cleaner, more sustainable future, reinforcing the country's resolve to accelerate sustainability within the sector.

Authored by: Saurabh Agarwal (Partner-EY), Parul Nagpal (Director-EY), Anshul Girotra (Manager-EY), Aman Agiwal (Consultant- EY)

[50] Vehicle Scrappage Policy in India: Highlights and Benefits (acko.com)

Reducing the carbon footprint in the automotive industry

by

Grant Thornton

Grant Thornton

#GTBharat
SHAPING VIBRANT INDIA

Reducing carbon footprint in the automotive industry

Sustainability for Competitiveness

Automotive Component Manufacturers Association of India (ACMA)

August 2023

Table of Contents

Background 4

Global context 5

Global Automotive Production Statistics 5

Trends shaping the industry in 2023 6

Regulations governing automotive emissions in the EU 7

Integrated approach for environmental concerns 9

The Indian scenario 10

India's automotive excellence 10

Driving India's economy and ecology 10

Regulations shaping sustainability 12

Consumer behaviour trends and results 13

Financial implications 14

International economy 14

Indian context 14

Climate change induced risks and opportunities 16

Emissions in the automotive industry 20

Levers for emission reduction 22

Sustainability framework for the automotive industry 24

Challenges faced by the automotive industry in the sustainability journey 26

Acknowledgement 28

Table of Figures

Figure 1: World Motor Vehicle Production 5
Figure 2: National Auto Production 11
Figure 3: Automotive industry exposure to climate change risk as a percentage of financial impact. 17
Figure 4: Automotive industry opportunity creation potential as a percentage of financial impact. 19
Figure 5: Relevancy Scale of Scope 3 categories for the Automotive Industry 21

Abbreviations

BS6	Bharat Stage Emission Standards 6
CAGR	Compound Annual Growth Rate
CD	Cylinder Deactivation
CNG	Compressed Natural Gas
EU	European Union
EV	Electric Vehicles
GDP	Gross Domestic Product
GDI	Gasoline Direct Injection
GHG	Greenhouse Gas
OEM	Original Equipment Manufacturer
OICA	International Organization of Motor Vehicle Manufacturers
SCR	Selective Catalytic Reduction

Background

Climate change is no longer a distant reality and people across the globe are already feeling its repercussions. The automotive industry being a key emitter of carbon-di-oxide (CO_2), it becomes important to gauge the different scopes of emissions and ways to reduce the carbon footprint in the industry. Greenhouse gases (GHG), when present in the atmosphere, absorb and trap certain radiations, resulting in the greenhouse effect. These gases, trap heat in the atmosphere, leading to the warming of the planet. As per the Green House Gas (GHG) protocol[1] emissions can be classified into three Scopes based on the control and ownership of the assets causing emissions. These are described as Scope 1, Scope 2 and Scope 3.

Scope 1 emissions are direct GHG emissions that occur from sources that are owned or controlled by the company. Examples include emissions from combustion in owned or controlled manufacturing sites and factories.

Scope 2 emissions accounts for GHG emissions resulting from the generation of purchased electricity consumed by the company. Purchased electricity refers to electricity that is bought or otherwise brought into the organisational boundary of the company. Scope 2 emissions physically occur at the facility where the electricity is generated.

Scope 3 encompasses all other indirect emissions. These emissions are a consequence of the company's activities but originate from sources that are neither owned nor controlled by the company. For example: Emission occurring from burning of petrol and diesel by cars and vehicles used by consumers. There are a total of 15 categories defined by GHG Protocol under Scope 3 emissions. These comprises upstream and downstream emissions in the value chain including emissions from business travel, employee commuting and from purchased good and services.

With rising emission levels, the average temperature of the globe is increasing causing global warming. To counter this different scenarios are computed which aim to reduce emissions and ultimately driving it to net zero level by 2050. Net zero emissions refers to the balance between the amount of GHG that is produced and the amount that is removed from the atmosphere. It can be achieved through a combination of emission reduction and emission removal [2].

[1] https://ghgprotocol.org/

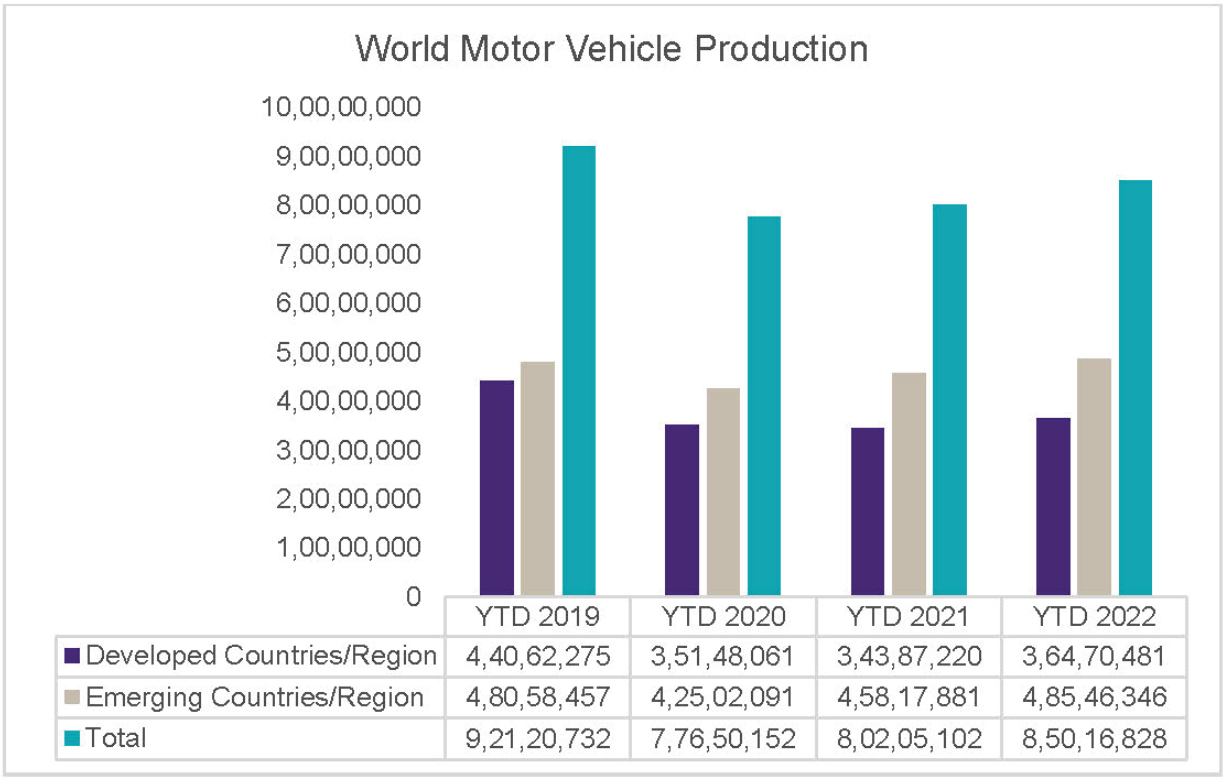
[2] https://www.nationalgrid.com/stories/energy-explained/what-is-net-zero

Global context

Currently, the global automotive sector is faced with a myriad of challenges and trends. The industry's trajectory has been significantly impacted by the COVID-19 pandemic, leading to reduced production and sales, further compounded by chip shortage, which is important to boost fuel efficiency. Simultaneously, there is a transformation towards electric vehicles (EVs) propelled by governmental regulations, consumer preferences and technological advancements.

The demand for connected and personalised vehicles is rising significantly, driven by the proliferation of mobile devices. As the industry navigates these dynamics, adapting to the aftermath of the pandemic, embracing EVs, managing autonomous vehicle complexities and catering to connectivity, demands are central to its evolution.

Global Automotive Production Statistics



	YTD 2019	YTD 2020	YTD 2021	YTD 2022
Developed Countries/Region	4,40,62,275	3,51,48,061	3,43,87,220	3,64,70,481
Emerging Countries/Region	4,80,58,457	4,25,02,091	4,58,17,881	4,85,46,346
Total	9,21,20,732	7,76,50,152	8,02,05,102	8,50,16,828

Figure 1: World Motor Vehicle Production[3]

Figure 1 depicts worldwide motor vehicle production, drawing from data collected in the survey conducted by International Organization of Motor Vehicle Manufacturers (OICA).

[3] https://www.oica.net/category/production-statistics/

The data indicates a notable decline of 20% in production within developed countries, juxtaposed with a marginal increase of 1% in emerging countries. The classification of developed countries encompasses EU15, NAFTA (Canada, Mexico, USA), Japan, South Korea, and Australia, whereas emerging countries refer to all other regions.

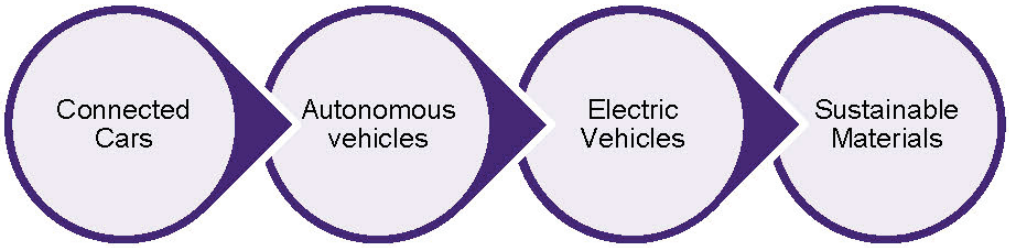
Projected growth trajectory for global automotive market

Despite challenges, the worldwide automotive industry is projected to expand. This growth is propelled by emerging markets such as China and India, where economic growth and rising incomes drive automobile demand. Technological progress, including innovative materials and manufacturing processes, further fuels the sector, enhancing fuel efficiency, safety, and affordability. Amidst myriad influences driving change in 2023, the global automotive sector stands on the brink of growth, propelled by expanding markets and significant technological advancements.

In a net-zero context, low-emission car sales are projected to increase from 5% of global new-vehicle sales in 2020 to nearly 60% by 2030[4]. This trend extends to road mobility sectors — passenger cars, buses, two/three-wheelers and trucks.

Trends shaping the industry in 2023

Here are some specific trends in the automotive sector in 2023:



- Connected cars are gaining traction for their safety and convenience features. They communicate with vehicles, infrastructure, and smartphones, providing hazard alerts, traffic updates and automated parking.

[4] https://www.mckinsey.com/capabilities/sustainability/our-insights/spotting-green-business-opportunities-in-a-surging-net-zero-world/transition-to-net-zero/road-mobility

- Autonomous vehicles are in the nascent stage of development but hold transformational potential for transportation. They might eliminate accidents, ease congestion, and offer mobility to non-drivers.
- Growing demand for EVs arises from their advantages over gasoline vehicles such as fuel efficiency, zero emissions, and reduced noise pollution. These appeals to the consumers and makes them an eco-friendly choice.
- The auto industry's push for eco-friendliness fuels the use of sustainable materials, such as recycled plastics and fabrics, aligning with environmental concerns and driving positive impact through vehicle interior innovation.

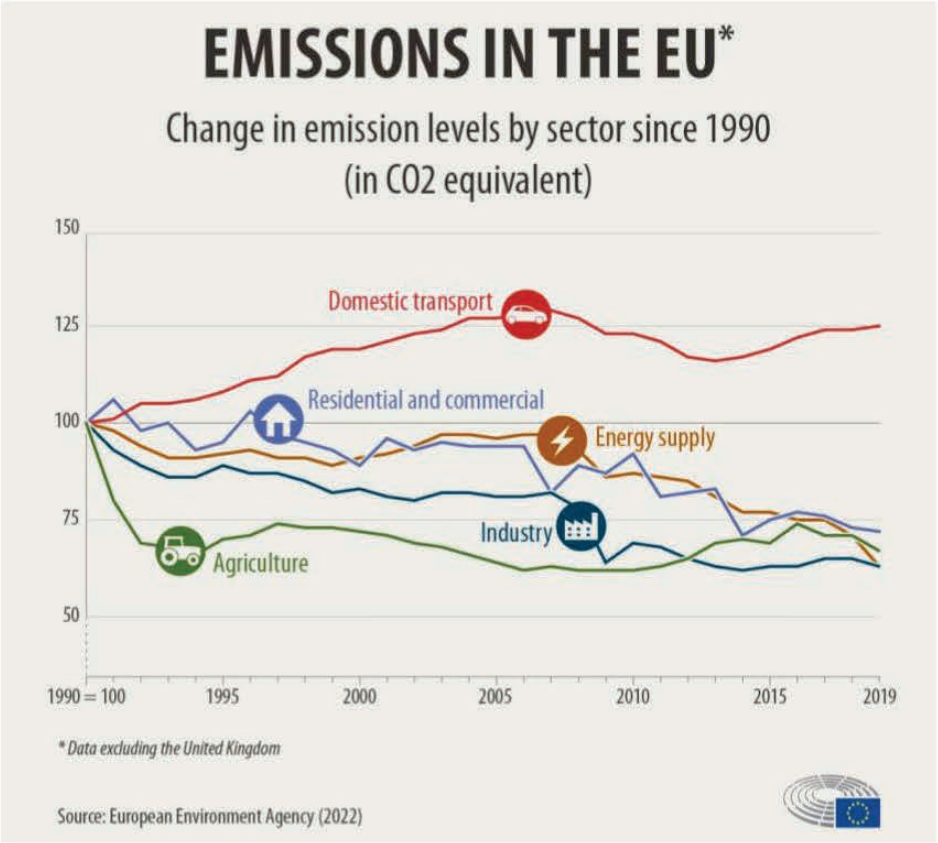
These are just a few of the trends that will be shaping the global automotive sector in 2023. The automotive industry is undergoing a significant transformation, and it will be interesting to see how these trends play out in the coming years.

Regulations governing automotive emissions in the EU

The urgency for sustainability in the automotive sector is evident due to its carbon intensity. Globally, transportation contributes to 23% of energy-related CO_2 emissions[5], with road transport comprising 72% of the EU's transport GHG emissions. Road vehicle tailpipe emissions alone represent nearly 75% of mobility sector carbon emissions[6], equivalent to around 6 billion metric tons of CO_2 annually and around 15% of worldwide CO_2 emissions.

[5] https://www.itf-oecd.org/decarbonising-transport#:~:text=The%20Decarbonising%20Transport%20initiative%20promotes,affects%20lives%20around%20the%20globe.

[6] https://op.europa.eu/en/publication-detail/-/publication/14d7e768-1b50-11ec-b4fe-01aa75ed71a1



As per the report by OICA[7], recent EU legislation strives to enhance air quality and counter climate change, with the EU Green Deal presenting additional regulations. Euro 6 Real Driving Emissions (RDE) and Euro 6d advance pollutant control technology bridges the real-world and lab emission gaps. Euro 6d-TEMP diesel vehicles showcase lowered on-road NOx and PN (particle number) emissions through testing. The worldwide harmonised light vehicle test procedure (WLTP) assesses real-world fuel consumption and CO_2 emissions. Reduced CO_2 emission targets for new passenger car fleets are set for 2025 and 2030 to combat climate change. Efficiency of modern diesel vehicles together with electrification aids in achieving these goals.

Globally, governments are implementing policies for eco-friendly automotive sectors. In the EU, emission reduction goals and policies to curb fossil fuel used in the auto sector have already been enacted. This includes:

- **Fuel prohibitions:** The EU's fresh CO_2 targets intend to curtail road transport emissions, with 55% and 50% interim reductions for cars and vans, respectively, by 2030. Approved

[7] https://www.oica.net/wp-content/uploads/200901-modern-diesel-MTZ.pdf

in February 2023, these goals reinforce the transition towards a green automotive and fleet sector, accentuated by the 2035 ban on new petrol and diesel cars.

- **Green Deal Industrial Plan (GDIP):** Published on 1 February 2023, the EU's Green Deal Industrial Plan (GDIP) aims to improve European industrial competitiveness while transitioning to climate neutrality for sustainable prosperity. It responds to global net-zero industrial initiatives, encouraging decarbonisation and innovation via existing subsidies. The GDIP aims to fortify the EU industry through four pillars — a streamlined regulatory framework, expedited funding access, skill enhancement and resilient supply chain trade.
- **Introducing the Emissions Trading System (ETS):** To reinforce reduced CO_2 emission goals, the EU introduces additional measures — a new emissions trading system for transport and buildings, expanded renewable transport fuels, fossil fuel tax changes, and revising alternative fuels infrastructure.
- **Corporate sustainability reporting directive (CSRD):** Effective FY 2024, the CSRD mandates large companies to regularly disclose environmental and social impact activities. This facilitates assessment by investors, consumers, policymakers, and stakeholders, fostering responsible business practices. The CSRD imposes substantial obligations on automotive and fleet corporations, necessitating prompt establishment of meaningful sustainability metrics and KPIs.

Integrated approach for environmental concerns

OICA has suggested[8] that legislation tends to prioritise CO_2 emissions from new vehicles rather than adopting an integrated approach involving all relevant stakeholders. This, in turn, overlooks the potential benefits of a more holistic and collaborative approach to address environmental concerns effectively. This is outlined below:

- **Evolving vehicle engineering:** Enhance the efficiency of new automobiles and trucks through advancements in vehicle technology to lower the average CO_2 emissions produced by these vehicles
- **Fuelling sustainable solutions:** Promote the development of environmentally sustainable fuels and establish necessary infrastructure for their distribution, thereby diversifying energy sources and reducing environmental impact in the transportation sector

[8] https://www.oica.net/category/climate-change-and-co2/

- **Optimising infrastructure:** Enhance traffic movement and mitigate inefficient congestion through improved infrastructure measures
- **Enhancing driver practices:** Educate drivers about practices to diminish fuel usage and CO_2 emissions, enhance road safety by altering driving behaviour for a green and safe transportation approach
- **Carbon-driven taxation:** Shape consumer preferences and buying decisions to foster reduced CO_2 emissions in driving behaviour, leveraging CO_2-related taxation strategies

The Indian scenario

India's automotive excellence

In the global landscape, India stands tall as the third-largest automobile market, showcasing its prowess in various segments. During FY2021-22, the Indian automotive industry[9] exhibited its vitality by producing a substantial 22.93 million vehicles, across passenger, commercial, three-wheelers, two-wheelers and quadricycles. Notably, India's position in the international heavy vehicles space is formidable, being the largest tractor manufacturer, second-largest bus manufacturer and third-largest heavy truck manufacturer worldwide.

It significantly bolsters India's GDP, constituting 6% of the total and 35% of the manufacturing GDP. The EV domain foresees substantial growth, with an anticipated 49% CAGR between 2022 and 2030, aiming for 10 million annual sales by 2030 and generating 50 million job opportunities. Projections also indicate a USD 50 billion EV financing market by 2030. FY2022-23 reported record passenger vehicle sales at 2,504,084 units. Looking ahead, the truck market in India is poised to expand by more than fourfold by 2050. This thriving sector's value exceeds USD 222 billion, contributing 8% to exports and 7.1% to GDP.

Driving India's economy and ecology

Original equipment manufacturers (OEMs) within the automotive sector emerge as significant catalysts for India's economic progress. The automotive manufacturing domain constitutes a remarkable 49% share of the country's manufacturing gross domestic product (GDP), contributing 7.5% to the overall GDP and fostering 32 million employment opportunities[10]. This status positions it as a cornerstone of the economy.

---

[9] https://www.investindia.gov.in/sector/automobile

[10] https://www.capgemini.com/in-en/insights/expert-perspectives/sustainability-in-automotive-industry-an-india-perspective/

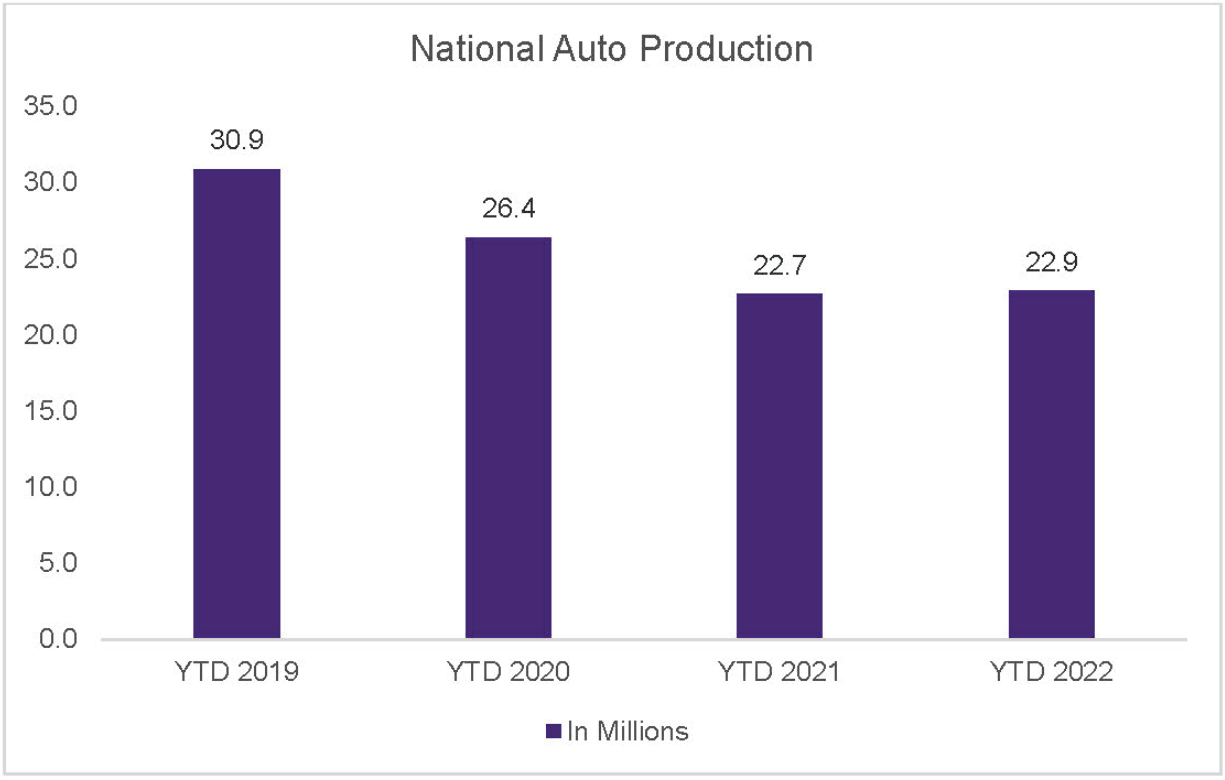


Figure 2: National Auto Production[11]

On the global scale, India is the fourth-largest automotive market, with a penetration rate of 33 automobiles for every 1,000 individuals. At the same time, the country is the third-largest emitter of GHGs, after China and the US. This carbon footprint, predominantly from road transportation, manifests as 90% of the total CO_2 emissions.

In response to this ecological challenge, India, as a rapidly emerging country, has embarked on a trajectory towards constructing a resilient and low-carbon economy. A pivotal means to realise this ambition is vigorously promoting and adopting electric vehicles (EVs). Through this green revolution, the automotive industry finds itself in a momentous role as a vital contributor to India's overarching goal of attaining carbon neutrality or net zero emissions by 2070.

Therefore, with its OEMs and dynamic evolution, the automotive landscape is a driving force in the national economy and an instrumental player in steering India's path towards sustainable environmental practices.

[11] https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/feb/doc2023217160601.pdf

Regulations shaping sustainability

India ranks as the third-largest contributor to global GHG emissions. Achieving net zero entails avoiding the addition of further GHG to the atmosphere. Part of this effort involves reducing one billion tonnes of projected carbon emissions by 2030.

In April 2020, the automotive sector, particularly passenger vehicles, underwent significant changes with the enforcement of stringent BS6 norms. This led to car manufacturers shifting away from diesel engines, and opting for petrol or CNG, or exploring electric options. In 2023, the industry has started gearing up for the next phase of BS6 emission norms, referred to as BS6 2.0. Few vehicles confirming to BS6 2.0 are already in the market.

BS6-compliant vehicles must run on engines emitting low NOx and particulate matter, meeting prescribed limits through Lean NOx Trap or selective catalytic reduction (SCR). This ensures clean fuel combustion with reduced pollutants. BS6 2.0 will impose even strict emission standards, demanding compliance in real-world conditions and laboratory tests. To achieve this, engines will require upgrades and onboard self-diagnostic devices to monitor driving behaviour and traffic conditions.

Achieving BS6 Stage 2 compliance for diesel engines involves high capacity engines adhering to SCR using AdBlue as a catalyst. This upgrade is costly for carmakers with small engines, leading some brands to discontinue diesel-powered budget vehicles. In the future, expect carmakers to introduce new BS6 2.0 models or retire some from their line-up.

Panchamrit

The core areas, represented as "nectar elements" or *'Panchamrit*,' outlining India's climate initiatives during the 26th session of the Conference of Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC), encompass:

- Attaining 500 GW non-fossil fuel energy capacity by 2030
- Aiming for 50% of India's energy demand to be fulfilled by renewables by 2030
- Curbing total anticipated carbon emissions by one billion tonnes between 2022 and 2030
- Decreasing the economy's carbon intensity by 45% by 2030 compared to 2005
- Striving to achieve the goal of net zero emissions by 2070

Consumer behaviour trends and results

The rate of the global shift to electric vehicles varies notably among different markets. Except for China, hybrid technology is more popular than full-battery electric vehicles (BEVs). The prevailing trend in consumer preference for EVs is primarily rooted in the perception of significant reductions in vehicle operating costs rather than being driven primarily by climate change concerns.

The analysis[12] by Grant Thornton Bharat aims to focus on consumer sentiments and factors influencing purchasing decisions, along with their willingness to transition to the new dynamics presented by the industry. We conducted a survey to evaluate this.

The pandemic-induced changes have reshaped the vehicle demand and supply dynamics in the past two years. Survey findings reveal a significant trend within the passenger vehicles sector — consumers' growing inclination towards hybrid and EVs, indicate a shift towards more sustainable and efficient transportation options.

The near future anticipates an increased acceleration towards e-mobility, driven by introduction of new electric and hybrid vehicle models. Survey results analyse this shift, with 31% of respondents expressing a preference for EVs and 39% for hybrid models. Remarkably, the preference for electric cars has witnessed a substantial 46% increase, while the inclination towards hybrid cars has surged by an impressive 62%. These statistics emphasise the evolving consumer mindset, with a significant proportion favouring environment friendly and technologically advanced transportation options.

[12] https://www.grantthornton.in/globalassets/1.-member-firms/india/assets/pdfs/auto-festive-survey-report.pdf

Financial implications

International economy

The global automotive finance market is predicted to expand to USD 385.42 billion by 2028, with a 6.5% CAGR. Pandemic had induced a decline of around 6% in 2020. Globally, the pandemic's negative impact led to reduction in demand. However, the sudden surge in CAGR reflects the projected post-pandemic recovery and growth.

Shifting landscape in the pandemic

The automotive sector was significantly affected by the COVID-19 pandemic, particularly in 2020. According to OICA, the demand for new vehicles experienced a 3–4% decline and that for used cars dropped by 1–2% compared to 2019. However, sales began to recover after June 2020, when lockdowns eased in many countries. Some data shows a 3.2% rise in demand for new loans later in 2020 as compared to the same period in 2019.

Growth via online finance

Online loan services have significantly disrupted the industry by offering convenient mobile/web platforms for loan comparison and application. Rising vehicle costs drive demand for automotive finance. Developed countries showed saturation, while developing nations provided growth potential.

Electric vehicles

The automotive industry is transforming with the increasing global acceptance of EVs. Given the higher cost of EVs, the evolving landscape presents substantial prospects for the automotive finance sector. In 2019, EVs comprised 2% of total vehicle sales, projected to rise to 8% by 2028.

Indian context

NITI Aayog established the National Mission on Transformative Mobility and Battery Storage in March 2019. It aims to promote eco-friendly, interconnected, shared and comprehensive mobility endeavours in India through policy actions and strategies.

In a transformative move[13], the FAME-II scheme was restructured, resulting in an increase in the adoption rate of electric two-wheelers from 3.5% to a remarkable 72% within eleven months. Simultaneously, a ground-breaking step was taken with developing the world's largest electric

[13] https://www.niti.gov.in/sites/default/files/2023-02/Annual-Report-2022-2023-English_06022023_compressed.pdf

bus tender for 5,450 e-buses, leading to a substantial 18–24% price reduction during price discovery. NITI Aayog, in its pursuit of comprehensive electrification, launched the National E-Bus Programme, aiming for an aggregate demand of a staggering 50,000 e-buses, with almost 19,000 already at various deployment stages. This commitment to electric mobility inspired the State EV Accelerator Programme, prompting 33 states and Union Territories to formulate distinct EV policies. The Cabinet has approved the "PM-eBus Sewa" scheme[14], aiming to enhance urban bus services with 10,000 e-buses through a PPP model. The scheme will promote e-mobility, which diminishes noise, air pollution and carbon emissions as well as bring in economies of scale for procurement of electric buses through aggregation. This scheme will support bus operations for 10 years.

Amongst these advancements, the Accelerated e-Mobility Revolution for India's Transportation (E-AMRIT) was introduced, serving as a centralised repository of EV-related information, presented during COP 26. An emblem of sustainability efforts, the *Shoonya* -Zero Pollution Delivery Campaign united 140 industry partners, culminating in an impressive 70 million deliveries and 40 million rides, significantly reducing emissions.

COP 27: NITI Aayog's EV Initiatives

NITI Aayog, the UK, and the US initiated a ZEV Country Partnership at COP 27, offering targeted assistance to expedite India's ZEV adoption. India joined 45 other nations in launching Priority Actions for Road Transport Breakthrough for clean technologies against climate change. During side events, NITI Aayog, with the World Economic Forum, introduced an executive brief on financing India's electric two- and three-wheeler fleets.

Circular Economy Action Plan for Li-ion Batteries

NITI Aayog has formulated a Circular Economy Action Plan for Li-ion Batteries, addressing all battery lifecycle stages from creation to recycling.

Sustainable freight solutions

NITI Aayog, in partnership with ICLEI–Local Governments for Sustainability, South Asia, aims to strengthen initiatives for promoting low-carbon urban freight. Initially assisting Kochi, Shimla, and Panaji, the project's Phase-II expansion includes Gangtok, Imphal, and Ranchi.

e-FAST India: Transforming freight transport with electric solutions

[14] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1949430

In collaboration with World Resources Institute (WRI) India and with the support of World Economic Forum (WEF), CALSTART and RMI India, NITI Aayog unveiled a platform that brings together stakeholders in the freight sector. The platform aims to foster collaborations, advance supply and demand dynamics, and promote innovative solutions for electrified freight transport. This, the country's inaugural national electric freight platform, is called the Electric Freight Accelerator for Sustainable Transport – India (e-FAST India).

Driving innovation in hydrogen economy

NITI Aayog is actively managing the hydrogen economy initiative, convening brainstorming sessions led by the Vice Chairman. Leading industries presented insights on the hydrogen economy on 22 April 2021, shaping the collaborative framework developed by the S&T Vertical and Atal Innovation Mission to empower stakeholders and innovators.

Climate change induced risks and opportunities

The impact of climate-related risks and opportunities on an industry's operations is seldom direct and obvious. Therefore, identifying material issues is challenging. The automotive industry is at the crossroad of emissions from manufacturing and use of automobiles makes a difficult path to traverse. A robust climate-related risk assessment process helps identify the likelihood and magnitude of present and future climate-related impacts on the environment and business performance. India is ranked among the top-10 most climate-vulnerable countries according to the Global Climate Risk Index 2021 by German Watch[15]. When seen globally from the lens of the automotive industry, it is projected that the total risk from climate change is approximately USD 400 billion.

[15] https://germanwatch.org/sites/default/files/Global%20Climate%20Risk%20Index%202021_2.pdf

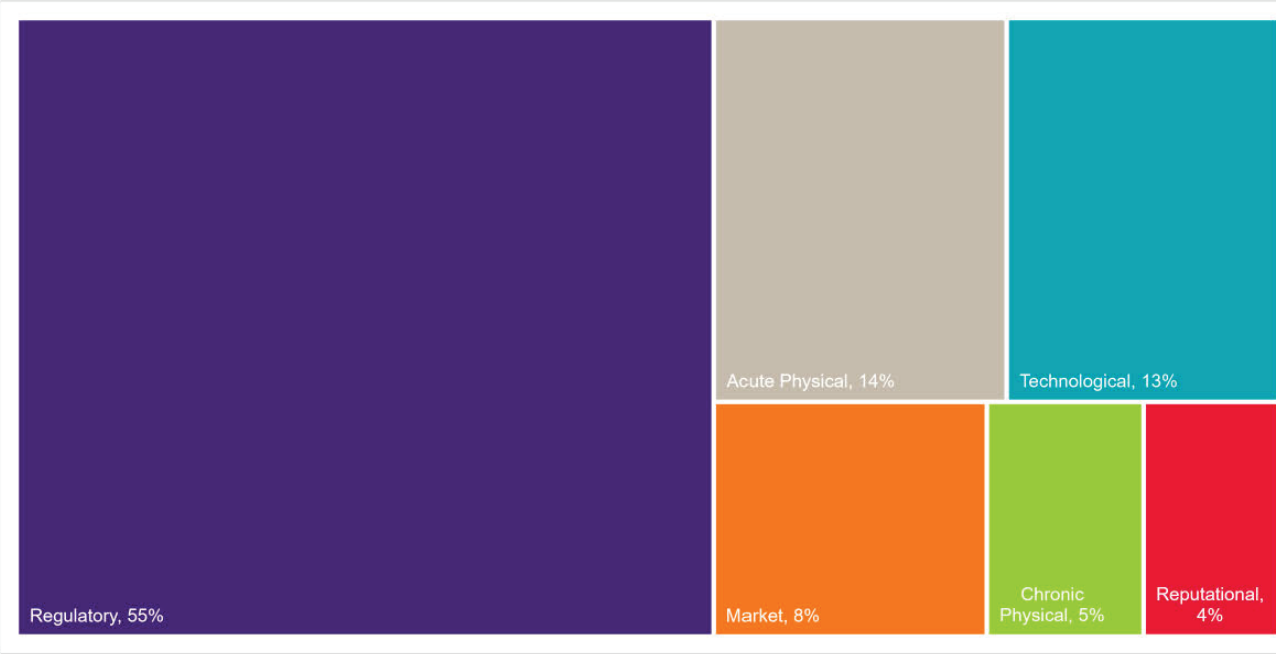


Figure 3: Automotive industry exposure to climate change risk as a percentage of financial impact.

Source: GT Analysis

Regulatory actions around climate change are continuously evolving. The objectives of regulatory changes are broadly classified into two categories, i.e., action that attempts to limit the adverse effects of climate change or regulatory actions that promotes adaptation to climate change. Some examples include implementing carbon-pricing mechanisms to reduce GHG emissions, shifting energy use towards lower emission sources, adopting energy-efficiency solutions, encouraging more extraordinary water efficiency measures and promoting more sustainable land-use practices. Leading automotive companies are raising concerns about risks posed by climate change issues. The foremost among these are regulatory risks, which arise primarily because of emission taxation, carbon-pricing mechanism, and carbon taxes etc. In the Indian context, the likely introduction of new emission norms (BS VI CAFE 2.0) for automobiles will call for additional interventions by OEMs and prices of both petrol and diesel vehicles are set to fluctuate. The Indian automotive industry is witnessing a transition towards more robust, stringent, but environmentally impactful regarding curbing tailpipe emissions.

An equal weightage of risk is considered for acute physical and technological risk. Acute physical risks generally impact manufacturing sites and facilities, which are event-driven (acute) in climate patterns. These have financial implications for organisations, such as direct damage to assets and indirect impacts from supply chain disruption. Water availability, sourcing and quality may also affect organisations' financial performance, and extreme temperature changes affect organisations' premises, operations, supply chain, and employee safety.

Technological risks, especially the adoption of new technologies such as battery swapping, the adoption of fuel cell, or the use of alternative fuel in automobiles, still presents a challenge not only from a consumer viewpoint but also from an advancement in the technology adoption in the hot and humid climate regime for a country for example, India.

Innovation in the automotive industry has led to a wide array of technology available to manufacturers to achieve CO_2 emissions, fuel economy and performance goals. Several manufacturer-specific technologies emphasise the reduction of CO_2 emissions and increased fuel economy. Many manufacturers have adopted several technologies to enhance engine efficiency and thus reduce tailpipe emissions. Each manufacturer is choosing technologies that best meet design requirements of their vehicles, and in many cases, that technology is changing quickly. Engine technologies such as turbocharged engines (Turbo) and gasoline direct injection (GDI) allow for more efficient engine design and operation. Cylinder deactivation (CD) allows only a portion of the engine when less power is needed, while stop/start systems can turn off the engine entirely when idle to save fuel. Hybrid vehicles use a larger battery to recapture braking energy and provide power when necessary, allowing for a small, more efficiently operated engine. The hybrid category includes "full" hybrid systems that can temporarily power the vehicle without engaging the engine and small "mild" hybrid systems that cannot propel the vehicle independently. Transmissions with more gear ratios, or speeds, allow the engine to operate near peak efficiency more frequently.

Rising anthropogenic carbon levels in the environment not only pose risks but also present opportunities to battle the impacts of climate change and, in the process, create stimulus in the market for robust and clean technologies for disruption. In the automotive industry, the emergence of the use of low-emission vehicles is creating opportunities for companies across the value chain. Some opportunities include manufacturing of EV batteries and fuel cells; raw material sourcing to make these batteries and fuel cells; building, operating, and maintaining the charging infrastructure of these EVs and refuelling fuel cells; and creating new age technology to help integrate the new vehicle infrastructure with the existing power grid. The net-zero scenario could also give rise to e-hailing and micro-mobility services (e-bikes and e-scooters). A study based on Network for Greening the Financial System (NGFS) Net Zero 2050 scenario reflects that close to USD 3.4 trillion are likely to be spent on low-emission vehicles, their charging and fuelling infrastructure and upstream production of electricity and hydrogen[16].

[16] https://www.mckinsey.com/capabilities/sustainability/our-insights/spotting-green-business-opportunities-in-a-surging-net-zero-world/transition-to-net-zero/road-mobility

Adoption-Electrification-Acceleration: The opportunity cycle for the automotive industry can be trifurcated with the adoption, electrification, and acceleration of new, clean, and more efficient vehicle freights. The cause-to-impact ratio study of these three phases of the opportunity cycle suggests that a more significant push is required for the adoption and electrification phase, whereas the acceleration phase would follow the former phases. In line with the Task Force on Climate-Related Financial Disclosures (TCFD), five categories of opportunities arise because of climate change issues — products and services, markets, resource efficiency, energy source, and resilience. An analysis of the significant opportunities identified outlines that most opportunity creation for the automotive industry is likely to be done in the products and services category, which will fall in the adoption phase of the opportunity cycle.

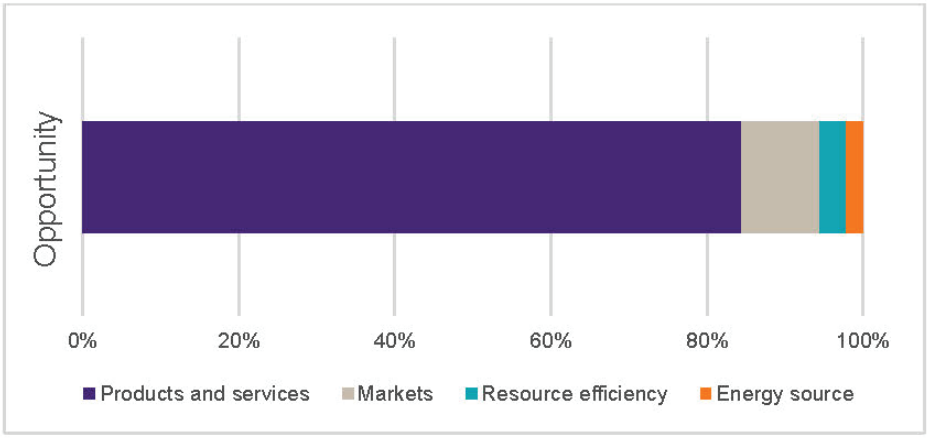


Figure 4: Automotive industry opportunity creation potential as a percentage of financial impact.

Source: GT Analysis

Emissions in the automotive industry

According to IEA, there was a rebound in passenger and cargo transport activities in 2022 after the COVID-19 pandemic led to a 3% increase in overall transport-related CO_2 emissions as compared to last year[17]. Traditionally, transport emissions have grown at an annual average rate of 1.7% from 1990 to 2022. The clean energy progress report 2023 suggests that the transport sector is not on track towards the NZE scenario by 2050. The modelled requirement is to reduce the emission by around 25% by 2030 for the transport sector to be in line with the NZE 2050 scenario[18]. Most of the emissions from the transport are tailpipe emissions as compared to the freight's manufacturing emissions. As discussed above, tailpipe emissions can be reduced through the opportunity cycle of adoption, electrification and acceleration of clean, lean and robust technologies in the automobile sector.

Scope 3 emissions, as defined by the Greenhouse Gas (GHG) protocol, are the result of activities from assets not owned or controlled by the reporting organisation but that the organisation indirectly affects in its value chain. Tailpipe emissions are categorised under Scope 3 emission under the use of sold products categories. The graph below outlines the relevance and importance of all 15 categories of Scope 3 emissions for automotive companies. The most important and relevant categories for any automotive industry are the use of sold products (which comprise the tailpipe emissions), followed by purchased goods and services and fuel- and energy-related activities. The scale of emissions from these categories is path-defining for the automotive industry in transitioning to net zero. To achieve this, automotive manufacturers are moving towards electric and clean freight manufacturing and exploring alternative fuels or fuels of the future for next-generation mobility.

[17] https://www.iea.org/energy-system/transport

[18] https://www.iea.org/reports/tracking-clean-energy-progress-2023

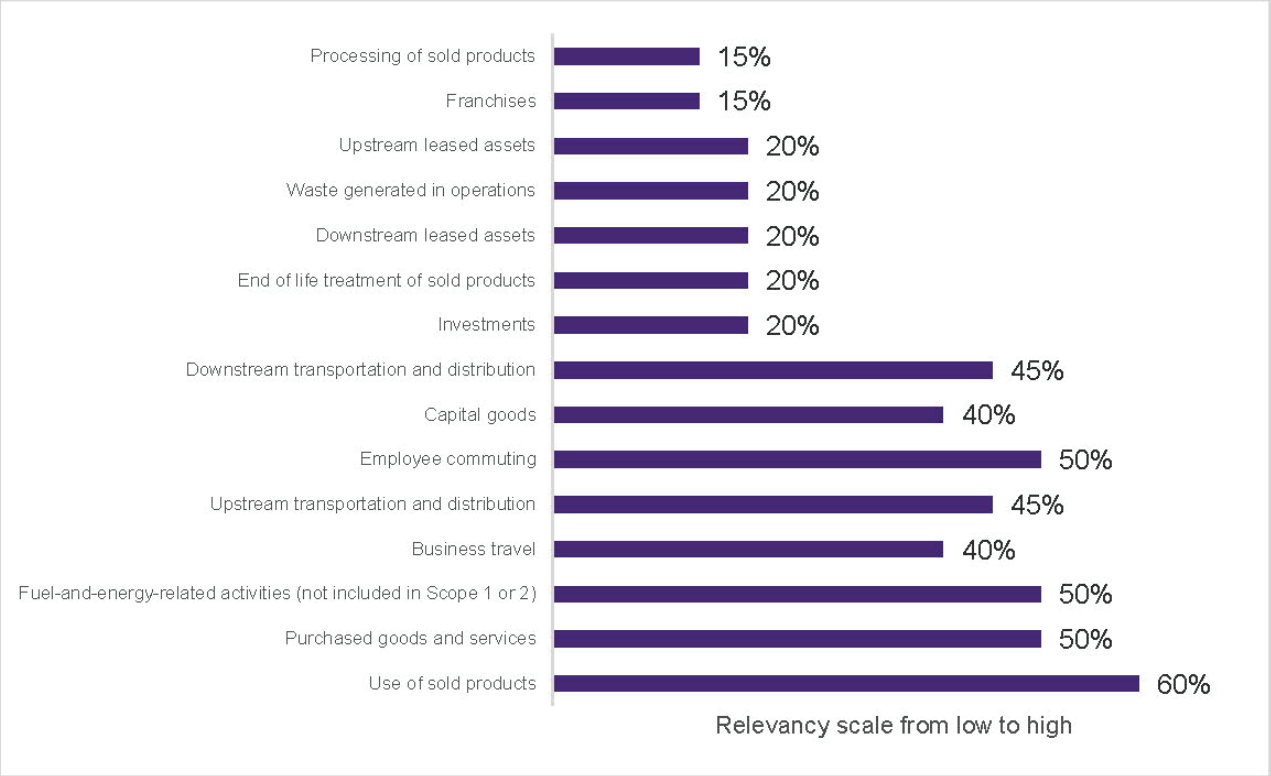


Figure 5: Relevancy Scale of Scope 3 categories for the Automotive Industry

Source: GT Analysis

From an Indian context, historically, the railways and two-wheelers have dominated India's passenger demand, but this may not be the case in the future. Numerous studies and the growth potential of the country signify that with rising income levels, four-wheelers will drive passenger service demand in future. The share of four-wheelers in motorised passenger service is expected to increase five folds, mainly driven by the desire to own a personal four-wheeler with growing income levels and on-demand mobility services.[19] This significant growth of four-wheelers is expected to come at the cost of reduced usage of other modes, e.g., two-wheelers and public transport. The share of public transport, mainly railways and buses, is expected to decline, which will significantly impact the Indian automotive industry from an energy and emission point of view. This also is also likely to increase congestion and infrastructure requirements. The passenger vehicle segment is set on a disruptive mode, especially with an increased uptake of electric vehicles. However, the upfront cost incurred in e-vehicles has created a bottleneck that deaccelerated the momentum. Some indicators that

[19] Kamboj, Puneet, Ankur Malyan, Harsimran Kaur, Himani Jain and Vaibhav Chaturvedi. 2022. India Transport Energy Outlook. New Delhi: Council on Energy, Environment and Water

can be used in assessing the efficiency of the automotive industry, especially in a country like India, can be defined as:

- The ratio of Scope 3 emissions to the sum of Scope 1 and 2 emissions.
- The ratio of electric penetration in the transport sector to the total fuel consumption.
- The share of public transport with rising GDP per capita for the country.

The metrics mentioned above will help quantify the automotive industry's decarbonisation rate from a manufacturing and a use-case scenario perspective. The three metrics track the energy penetration, emission intensity and economic prosperity of the society and development scenarios.

Levers for emission reduction

Companies in the automotive industry can use and implement strategies mentioned below to accelerate the emission reduction from different sources and nodes of operations. These are:

- **Carbon pricing:** It is an approach to reduce greenhouse gas (GHG) emissions by using market mechanisms to pass the cost of emissions onto emitters[20], usually by pricing the carbon dioxide equivalent (CO_2e) emitted. A carbon price works as an economic signal to polluters, and based on economic incentives, allows them to decide to either transform their activities, operate more sustainably and lower their emissions, or continue emitting and paying for them.

  There are two forms of carbon pricing — external and internal.

  External carbon pricing usually consists of:

  - The Emissions Trading Scheme (ETS): ETS caps the total level of emissions pertaining to GHG. It allows those industries with low emissions to sell their extra allowances to more significant emitters. This way, it acts like a cap-and-trade system.
  - Carbon taxes: CO_2 emissions can also be priced implicitly by Government policies encouraging emissions reductions, such as energy efficiency standards and renewable energy subsidies. This sets a price directly on carbon by defining a tax rate on GHG emissions or, more commonly, on the carbon

[20] https://www.carbonpricingleadership.org/what

content of fossil fuels. For example, India's excise duty on petrol and diesel is an implicit carbon tax.

Companies can voluntarily set an internal carbon price (ICP) to value the cost of a unit of CO_2 emission. This price varies depending upon the trade regions and objectives of individual companies. ICP is a strategic planning tool that, when implemented correctly, can help organisations in the transition to a low-carbon economy, as the fees collected can have a tangible impact on business operations and related decision making. Corporations have been using ICP as a strategic planning tool to manage climate-related business risks and prepare for the transition to a low-carbon economy. CDP (formerly Carbon Disclosure Project) showcased in their 2022 data that approximately 100 companies from the automotive sector have an internal carbon pricing, and another 150 companies intend to put a price on carbon in the next two years. By 2025, there will be close to 250 automotive companies that will be pricing carbon emitted from their operations and value chain.

- **Science-based targets to reduce emissions:** The science-based targets initiative (SBTi) is a global body enabling businesses to set ambitious emissions reduction targets in line with the latest climate science. It is focused on accelerating companies and financial institutions worldwide to halve emissions before 2030 and achieve net-zero emissions before 2050. The initiative is a collaboration between CDP, the United Nations Global Compact (UNGC), World Resources Institute (WRI) and the World Wide Fund for Nature (WWF) and is one of the "We mean business coalition" commitments. The initiative champions science-based target setting to boost competitive advantage of companies and financial institutions in transitioning to a low-carbon economy.

  Globally, approximately 480 companies from the automotive sector are committed to reducing their emissions by aligning or intending to align their business with the latest science of limiting warming to 1.5°C in line with the Paris Agreement. Out of the total 480 companies committed to the emission reduction initiative, 245 companies have already got their targets approved from the SBTi and are in line to align to decouple their businesses from the emissions [21]. From an Indian context, a total of 22 companies from the automotive sector are under this initiative, which is less than 10% of the total global companies under the initiative. Looking at the significant potential of companies

[21] https://sciencebasedtargets.org/companies-taking-action

in India striving to reduce their emission, it is highly likely that there is an upsurge in participation of Indian companies in these global initiatives.

Sustainability framework for the automotive industry

To assess and accelerate progress in sustainability, automotive companies should have a robust framework that can help decouple emissions from business growth. One such framework can be explored as follows:

- **Integrate vision:** Long-term ambition on sustainable action, defined and declared strategy, goals and assessment of climate change-induced risks and opportunities
- **Implement engagement:** Multi-stakeholder partnership within and outside the automotive value chain on adapting and mitigating environmental impacts
- **Instil governance:** Top-level definition of how sustainability is managed, including specific responsibilities of executives at different levels of the organisation
- **Iterative transformation**: Operational activities involving other value chain partners and support transitioning towards low emission intensive business.

A broader sustainability best practice module for the automotive industry, in accordance with the above framework, can be explored below:

- **Demonstrate progress through disclosure:** The first and most important aspect of sustainability is demonstrating and tracking progress through disclosures. With the reporting and disclosure landscape evolving at an increased pace both from the regulatory and voluntary point, it becomes essential for automotive entities to communicate their progress against key sustainability measures to their stakeholders. With the advent of regulatory requirements such as the Corporate Sustainability Reporting Directive (CSRD) in the European Union and Business Responsibility and Sustainability Reporting (BRSR) in India, governments and regulators are primarily interested in putting non-financial disclosure in the mainstream. These disclosures not only help in a transparent communication of sustainability initiatives but also promotes peer-to-peer learning of best practices both regionally and globally.
- **Sustainability as the organisation's mission:** Automotive players create focus departments on sustainability by including distinct expertise with a unique set of requirements, promoting sustainability in existing processes and constantly looking for

change and innovation. Organisations should consider creating separate departments for different initiatives for a more extended vision.

- **Governance and accountability:** Traditionally, the automotive industry has adopted a two-pronged strategy of cost savings and efficiency improvements as primary drivers of sustainability. However, there should be a long-term broad vision, which defines a purpose and sets accountability in the entire organisation. Sustainability should be considered driving commitments to the organisation's moral and ethical values. Organisations should imbibe sustainability in their culture, promote employee awareness, and advocate sustainability to the external world. Sustainability not only serves as accountability towards investors, customers, employees, and society but also helps attract new talents and retain the existing workforce.

- **Imbibing sustainability in the entire value chain:** By collaborating with different partners in the value chain, focusing more on customer needs and requirements through engagements and taking advantage of the current digitalisation could assist in lowering total cost and improving efficiencies.

- **Technology-enabled sustainability solutions:** Leading organisations must introduce technologies to promote sustainability and employee welfare. Automotive companies are already realising significant benefits from additive manufacturing or 3D printing technologies, which help in reducing waste. They can also learn from other sectors to implement energy-efficient solutions using AI. For example, Google uses AI to monitor the cooling of its data centres to reduce emissions and energy consumption.

- **Collaborative approach towards more significant impact:** The operations of the automotive industry are intricately linked across geographies. As a result, critical initiatives, such as the circular economy and developments in EVs, will not come to fruition without the active participation of all players. Collaboration will be key. For example, BMW, Scania, Volvo, and Volkswagen were lead partners in promoting a harmonised approach to driving sustainability in automotive procurement processes. It created a self-assessment questionnaire for suppliers for parts procurement. This questionnaire is now increasingly becoming the standard for the automotive industry.[22] Similarly, deploying material or component-related innovations in isolation (such as using biodegradable materials or recycled components) will only gain traction if value chain partners are on board.

[22] "10 of the biggest world automakers partner to launch 'DRIVE Sustainability,'" Drive Sustainability, March 2017

- **Government incentive programmes:** The programmes are meant to encourage Indian OEMs to focus more intently on their sustainability goals, both on the manufacturing and product use front. For example, the Government of India has announced a USD 3.5 billion incentive programme to increase EV production in India. Around 8–18% of EVs and components' total sales value will be allocated as incentives.

Challenges faced by the automotive industry in the sustainability journey

- **Lack of awareness on linking sustainability with business case:** Often, sustainability does not seem to make up a business case. However, with emerging times, large multinationals and mid-sized companies are increasingly taking a long-term view toward managing environmental and social risks. It is established that by addressing environmental and social issues, they can achieve better growth and cost savings, improve their brand and reputation, strengthen stakeholder relations, and boost their bottom line. Strategic integration of sustainability prepares companies to anticipate and understand long-term trends and the effect of resource use and address stakeholder expectations.
- **Lack of clear sustainability strategy:** Sustainability is a dynamic concept and evolving at a significant pace. Companies often need help to have a clear sustainability strategy on what and how to proceed as a next step. There needs to be clear guidelines on potential next steps in terms of decarbonisation. But with the advent of new technologies and initiatives, it is likely to have a clear view on the sustainability journey ahead.
- **Difficulty in measuring and reporting sustainability matrix:** With several reporting standards on the horizon, it becomes difficult for companies to decide and communicate their results too. However, as mentioned above, with more regulatory aspect emerging in recent times on reporting and disclosure, it would be a more transparent and robust reporting framework across all the hierarchies of companies in the sector.
- **Lack of relevant talent/skills:** With the advent of sustainability and increased emphasis on reimagining the business models with ingrained sustainability, it becomes more challenging for companies to identify relevant skills and talents in the team. With

a lot of institutional and academic collaboration with the industry, the sector and industry are bound to attract the right skill and expertise, thus leading to a larger talent pool to serve the notions of sustainability.

Acknowledgement

Authors

Abhishek Tripathi

Partner, ESG and Risk Consulting

Debraj Datta

Associate Director, ESG and Risk Consulting

Pratik Sanadhya

Assistant Manager, ESG and Risk Consulting

Kavya Tripathi

Consultant, ESG and Risk Consulting

Contact us

Scan the QR code to view our office addresses

www.grantthornton.in

For more information or for any queries, write to us at **GTBharat@in.gt.com**

Follow us @GrantThorntonIN

© 2023 Grant Thornton Bharat LLP. All rights reserved.

"Grant Thornton Bharat" means Grant Thornton Advisory Private Limited, the sole member firm of Grant Thornton International Limited (UK) in India, and those legal entities which are its related parties as defined by the Companies Act, 2013, including Grant Thornton Bharat LLP.

Grant Thornton Bharat LLP, formerly Grant Thornton India LLP, is registered with limited liability with identity number AAA-7677 and has its registered office at L-41 Connaught Circus, New Delhi, 110001. References to Grant Thornton are to Grant Thornton International Ltd. (Grant Thornton International) or its member firms. Grant Thornton International and the member firms are not a worldwide partnership. Services are delivered independently by the member firms.

Ethanol blended petrol as a path to decarbonization

by

ICRA

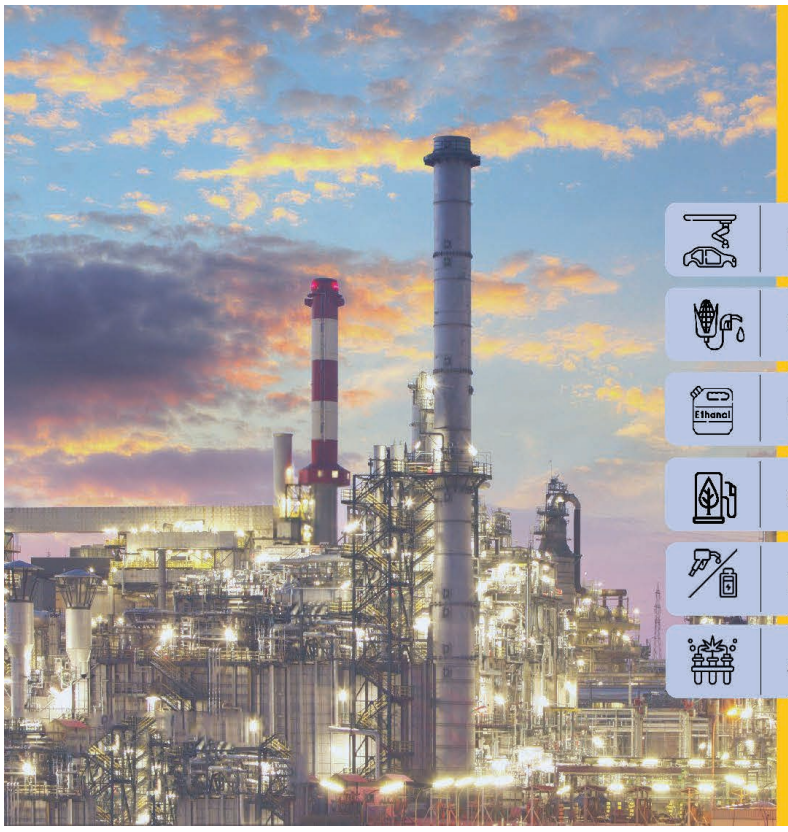
ICRA

Ethanol-blended petrol as a path to decarbonisation



Auto OEMs unlikely to face major challenges to comply with proposed ethanol blending norms

September 2023



Agenda

ICRA

- Evolving Powertrain Mix in Passenger Vehicles in India
- Overview of Ethanol Blending Norms in India
- E20 Implementation from Auto OEM Perspective
- Global Landscape
- Key Takeaways
- Annexure



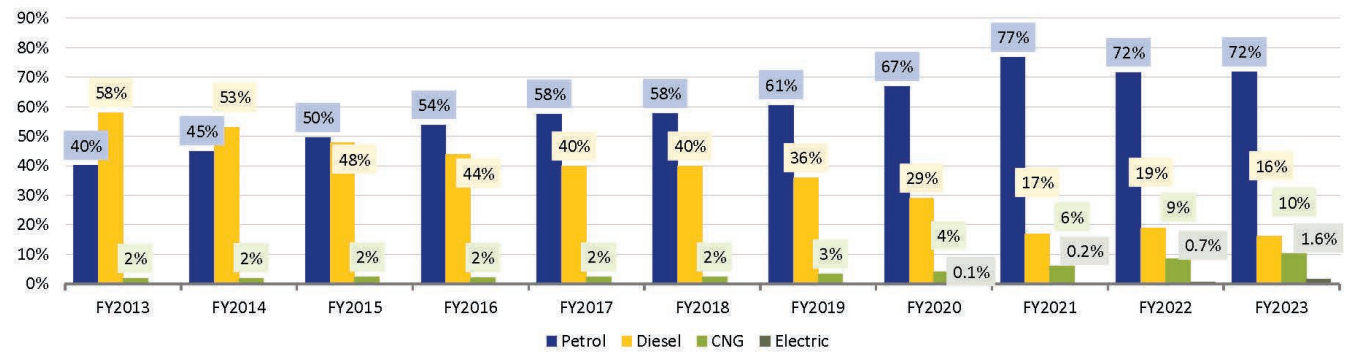
Powertrain Mix in Passenger Vehicles in India

Petrol to remain dominant over the medium term although adoption of alternate powertrains will rise

Petrol has emerged as a fuel of choice in the Indian passenger vehicle market

ICRA

Exhibit: Trend in powertrain mix for domestic passenger vehicles



Petrol vehicles have gained share as stricter emission norms and narrowing price gap between petrol and diesel has reduced viability of diesel vehicles.

CNG has also gained prominence over the past couple of years aided by - a) favourable running cost, b) improving penetration of CNG dispensing stations across the country and c) enhanced product offerings by OEMs.

Demand for EVs increased exponentially with the GoI's push, increasing awareness, and new launches. EV share remains low at sub 2% currently.

Source: SIAM, ICRA Research

Share of alternate powertrains including EVs to rise over the years

ICRA

CNG

- The operating economics of CNG remains favourable. Improving CNG fueling infrastructure coupled with new model launches will continue to aid consumer acceptability for CNG and drive penetration. It also helps OEMs in complying with impending CAFÉ norms.

Diesel

- Narrowing retail price gap between petrol and diesel fuels and increase in upfront price differential between petrol and diesel models have made cost economics of owning a diesel PV relatively less favourable.
- Regulatory overhang like ban on older diesel vehicles, complying with CAFÉ/RDE/emission norms and push for CNG in commercial taxi segment has dampened demand for diesel vehicles materially in select regions. Few OEMs have completely exited diesel powertrain offerings.

Electric + Hybrid

- EV ecosystem (ex. public-charging infrastructure) still needs to be developed in India, leading to range anxiety issues. Battery costs remain high due to increase in raw material prices, thereby delaying the timeline for pricing parity for EVs. Mass adoption of EVs is likely to only happen over the medium to long term. ICRA expects EV penetration in PVs to be 4-6% of new vehicle sales, by FY2025.
- Hybrids may see enhanced adoption over the next 3-4 years. Hybrid vehicles can switch between electric and normal driving modes, and thus help resolve range anxiety issues. Further, hybrids are estimated to deliver a 30-35% higher fuel efficiency compared to a pure gasoline vehicle, which is likely to help mitigate the upfront price differential. Hybrids, though costlier than gasoline vehicles, remain priced at a discount to electric vehicles.

CNG vehicles will continue to gain traction

ICRA

01 Favourable operating economics

02 Improving fueling infrastructure

03 New model launches by OEMs

04 Reduced emission which will help in meeting CAFÉ norms

Favourable TCOs, improving CNG fueling infrastructure and new model launches by OEMs will continue to aid consumer acceptability for CNG and drive penetration. Further, CNG-based vehicles also help in reducing emissions vis-à-vis petrol vehicles and help in meeting CAFÉ norms.

Confluence of factors to support EV adoption over medium term

ICRA

Exhibit: Key growth drivers for electrification across all segments

E-3W	E-2W	Electric Bus	Electric Car	E-LCV
Improving technology/ product portfolio	Government subsidies	Government Subsidies	Lower running cost	Improving technology
Lower ownership cost	Price parity with ICE 2Ws	Demand aggregation by govt backed entities	Improving technology/ product portfolio	Lower running cost
	Improving technology/ product portfolio	Lower ownership cost	Improving charging infrastructure	Decline in battery prices
	Commercial Usage/Lower dependence on charging infra		Decline in battery prices	
14-16%	10-12%	11-13%	4-6%	4-6%

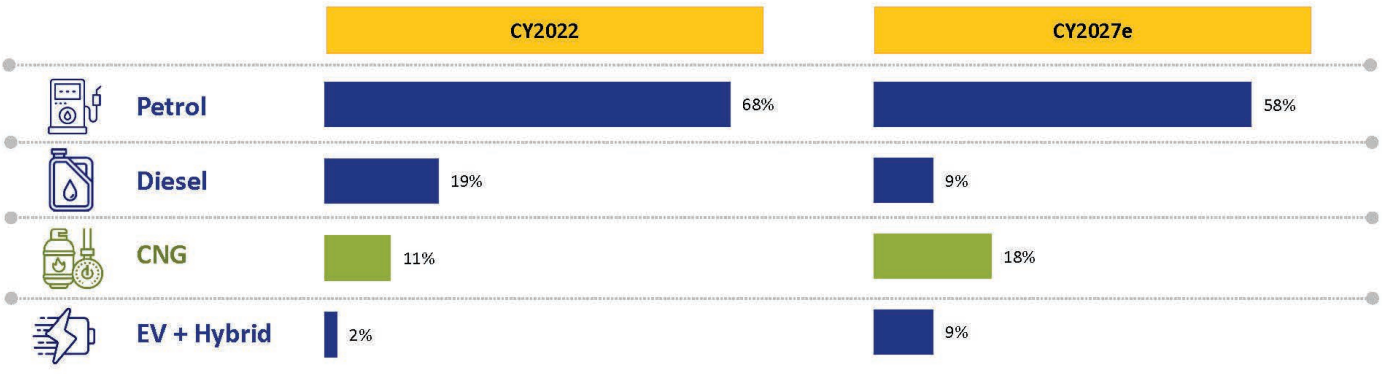
EV Penetration by FY2025

Source: ICRA Research

Petrol, however, will remain the dominant powertrain over the medium term

ICRA

Exhibit: ICRA's estimate of powertrain mix in passenger vehicles in India



- The proportion of CNG, EVs and hybrid is likely to increase as proportion of new vehicles sales in the next five years.
- However, petrol-based vehicles are likely to remain a significant portion of new PV sales over the medium term.
- This makes it critical to reduce emissions from petrol-based vehicles to meet CAFÉ norms and start the trajectory towards achieving carbon neutrality over the medium to long term, besides promotion through adoption of alternate powertrains, including EVs and hybrids.

Source: SIAM, ICRA Research



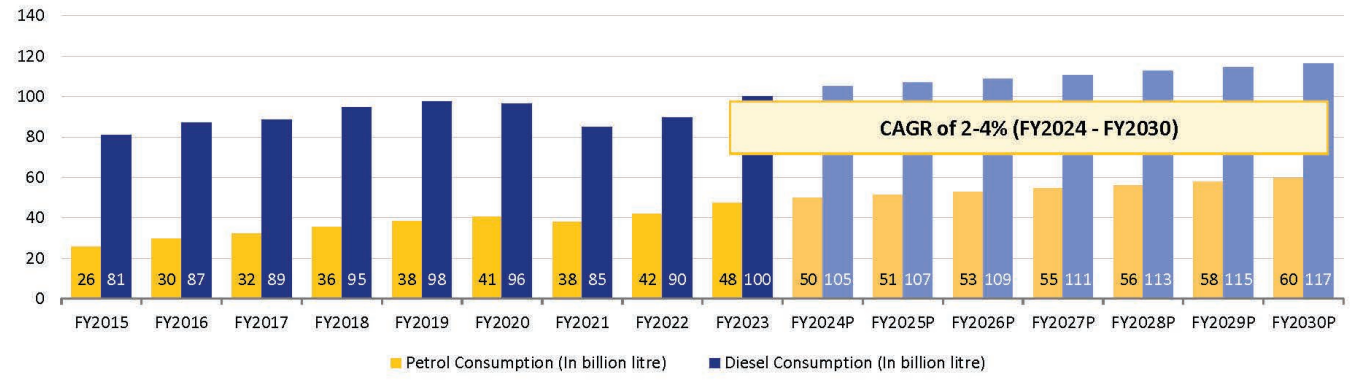
Overview of Ethanol Blending Norms in India

Increase in ethanol blending to facilitate achievement of India's net zero goals

Consumption of conventional fuels to increase with growth in automobile volumes

ICRA

Exhibit: Trend in domestic petrol and diesel consumption over the years (in billion litre)



- The medium-term outlook for the PV industry remains healthy aided by growing income levels, improving urbanisation, relatively weak public transport and under-penetration of PVs (about 30 cars per 1000 people). Accordingly, ICRA expects the PV industry to grow at a CAGR of around 6-9% over the medium term.
- The increase in vehicle penetration is likely to drive demand for petrol over the medium term. ICRA expects a CAGR of 2-4% in petrol consumption over the period FY2024 to FY2030.

Source: PPAC, ICRA Research

Ethanol blending with petrol offers multiple benefits

ICRA

Exhibit: Key advantages of ethanol blending

	Strengthens energy security and helps to reduce oil imports and conserve forex reserves
	Economical compared to petrol from a fuel cost perspective
	Reduces vehicular emissions; implementation of E20 will accelerate net zero goals
	Currently, the ethanol production is entirely from 1G source. It aids in controlling excess sugar supply in the country as ~65% of total ethanol production comes from molasses-based distilleries. Going forward, as 2G ethanol production increases, there would be incremental benefits including end use of agri-crop waste and lower water requirements.

Cost savings in E100 fuel over E10 petrol (As on August 18, 2023)	Unit	Cost of E10 petrol	Cost of E100 fuel		
			Sugarcane Juice	B heavy molasses	C heavy molasses
Price to Dealers (excluding Excise duty and VAT)	Rs/Lt	57.4	65.6	60.7	49.4
Excise Duty	Rs/Lt	19.9	0.0	0.0	0.0
Dealer Commission	Rs/Lt	3.8	3.8	3.8	3.8
VAT (Including VAT on dealers' commission)	Rs/Lt	15.7	18.7	17.4	14.4
Retail Selling Price in New Delhi	**Rs/Lt**	**96.7**	**88.1**	**81.9**	**67.5**

Source: PPAC, NITI Aayog, ICRA Research; E100 is pure ethanol fuel while E10 represents 10% ethanol blended petrol

Gradual increase in ethanol blending over the last several years

ICRA

Exhibit: Ethanol blending roadmap in India



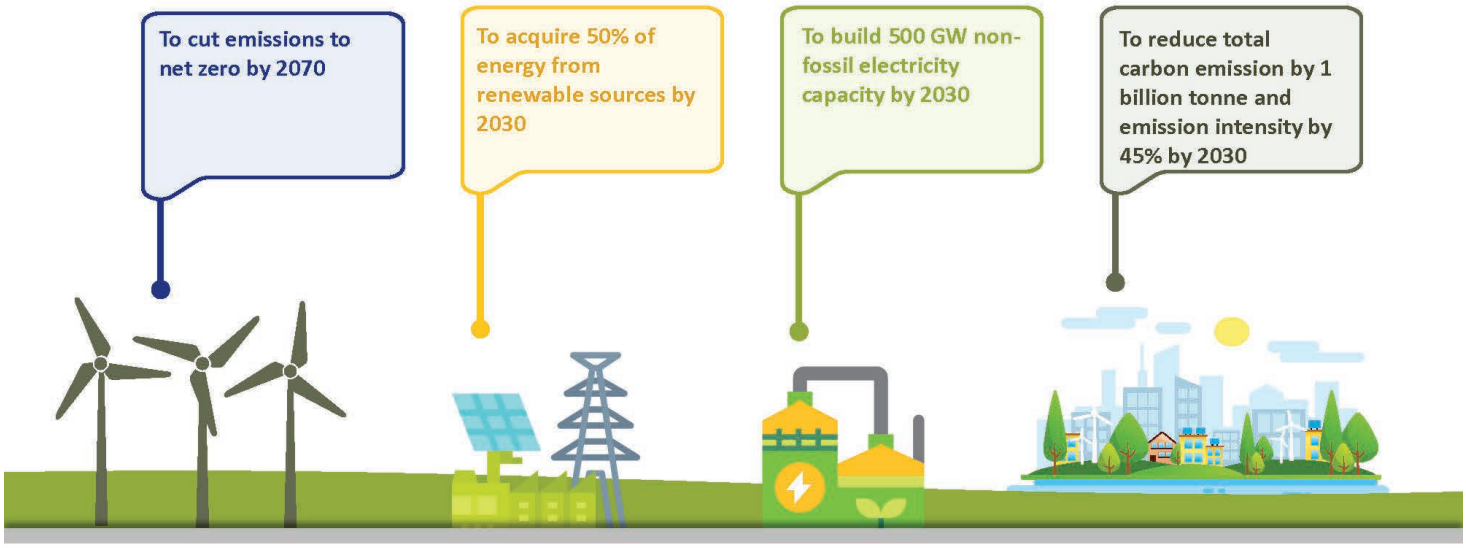
2003 & 2006	2008	2009	2012	2017	2018	2022	2025P	2030P
Government mandated 5% blending in 9 states and 4 union territories in 2003 and pan-India in 2006	Government mandated 10% blending pan India & vehicles made compliant with E10	National Policy on Biofuels released – Target to achieve 20% blending of ethanol by 2017	Mandatory 10% blending to achieve national average of 5%	Average ethanol blending in India was 2.3%; target to achieve 10%	Biofuel Policy 2018 released; E20 target by 2030	Average pan-India ethanol blending of 10% achieved in June 2022	Target to achieve 20% ethanol blending by 2025	Increase in ethanol blending rates & availability of flex fuel vehicles

Source: White Paper on Alternative Fuels for Vehicles by SIAM, Press Information Bureau – Government of India, ICRA Research

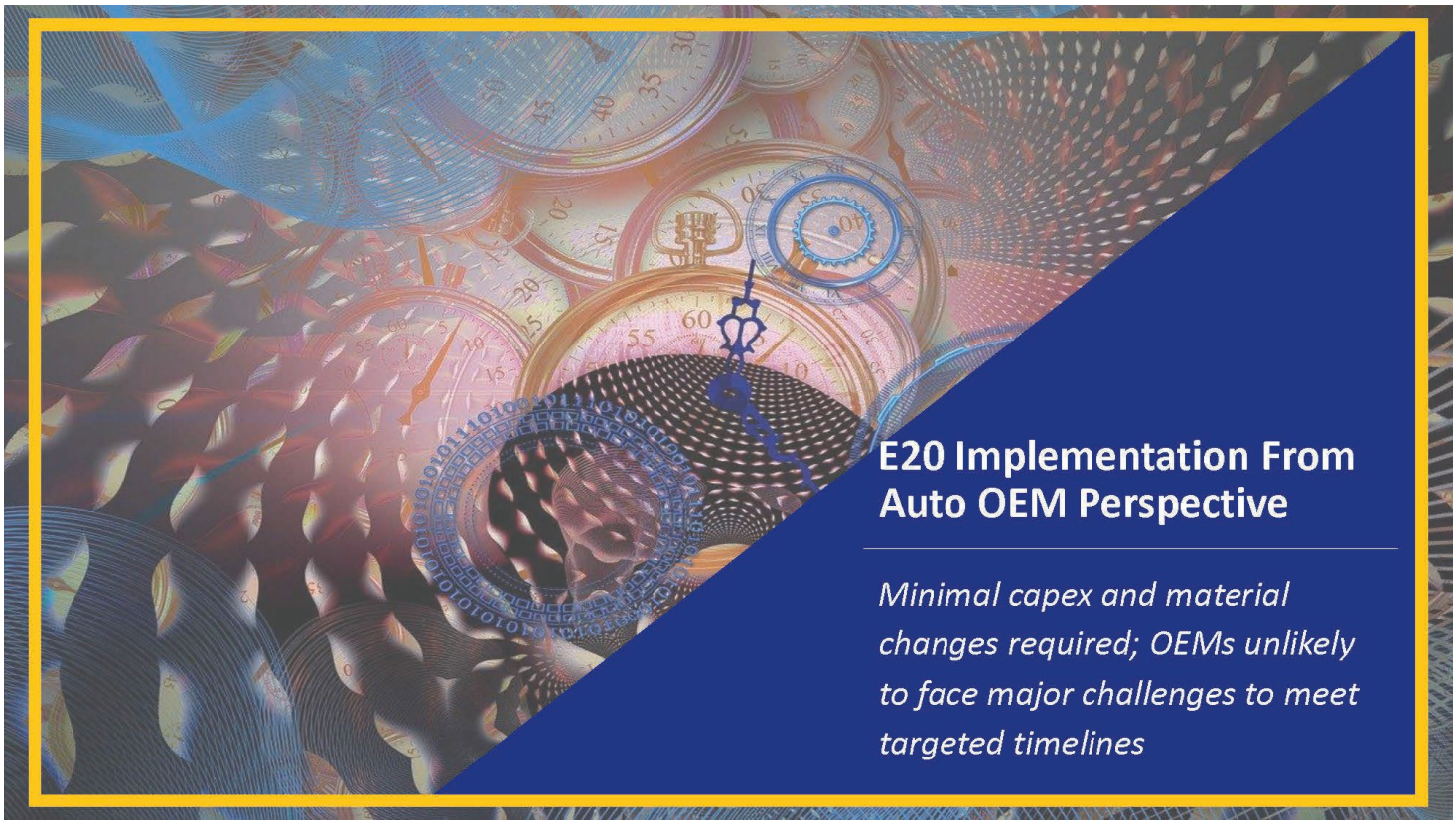
India's pledge at COP26 expected to accelerate ethanol blending further

ICRA

Exhibit: India's announcement at the COP26 summit



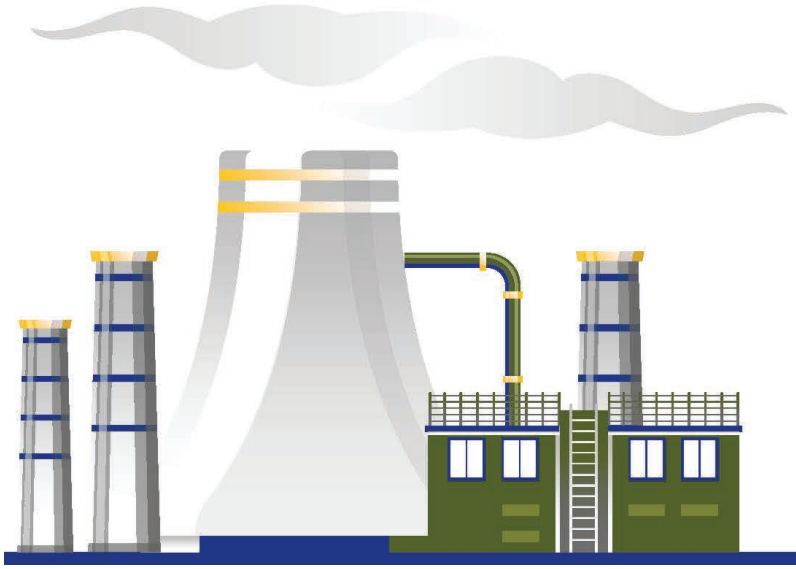
Source: ICRA Research



Addressing multiple issues critical for seamless E20 implementation

ICRA

Exhibit: Key issues to be addressed during the E20 transition



- OEM readiness - OEMs expected to be ready from the material, vehicle calibration and vendor development perspective for E20 implementation
- About 6% loss of fuel efficiency is expected as vehicles transition from E10 to E20-compliant design and this would increase the total cost of ownership (TCO)
- Compatibility of E20 fuel for older vehicles - Addressing compatibility issues of existing vehicle parc (designed for E10) with E20 fuel is critical. Not addressing will result in accelerated corrosion of engine components parts like fuel hoses and further loss of fuel efficiency
- From a supply-side perspective, making ethanol available in adequate quantities across the country and addressing portability challenges would be imperative

Source: ICRA Research

OEM readiness not a challenge to meet implementation timelines; no major capex envisaged

ICRA

Material and design compatibility

- Only some engine components such as fuel hoses, rubber parts, seals and O-rings need to be recalibrated with advanced materials.
- This would need alternate sourcing and imports in the interim, till such time local vendors are developed.
- Readiness on the materials front is not a challenge for OEMs.
- Engines would be redesigned with the advanced materials. Given the minimal changes required, elongated testing periods may not be required. The OEMs are unlikely to have any challenge in meeting the 2025 deadline.

Cost implications

- No major design changes are required from a vehicle standpoint except material recalibration. Impact on cost to be less than 1% per passenger vehicle and about 2-3% in the case of 2Ws.

Capex

- No significant change in the assembly line is expected. Only marginal changes (for instance, tooling) are required. Hence no major capex is envisaged for the E20 implementation. However, ancillaries will have to incur some investments.

Replacement demand potential for older vehicle parc

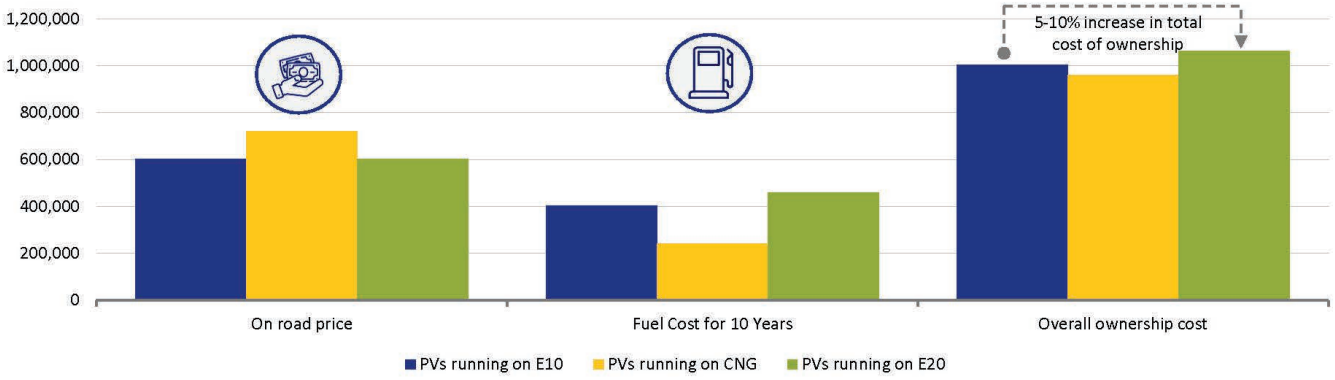
- Passenger vehicles which are currently running on the road are compliant with E10 fuel. Operating E10 compliant vehicles with E20 fuel would result in corrosion of certain engine components. Unless E10 and E20 fuels co-exist or retrofitment possibilities are discovered, there would be requirements to replace the corroded parts during the vehicle lifecycle.

Source: ICRA Research

Likely increase in TCO in E20 vehicles with lower fuel efficiency

ICRA

Exhibit: Total cost of ownership comparison between E10, CNG and E20 vehicles



- E20 vehicles are expected to be 6% lower in terms of fuel efficiency compared to E10 vehicles. This will increase the TCO as E20 gets implemented.
- The older vehicle parc, designed for E10, when run on E20 fuel, will witness further fuel efficiency loss. Also, there shall be corrosion of some engine components, necessitating replacement of these parts during the vehicle lifecycle. These would increase the TCO further for older vehicles running on the road.
- However, discovery of retrofitment parts in E10 vehicles and technology advancements for improving fuel efficiency could mitigate these challenges over the medium term.

Source: ICRA Research; Note: 1. Car and fuel prices are ex-Delhi, 2. Average annual running is assumed at 10,000 km and 3.TCO is calculated over a 10-year lifecycle



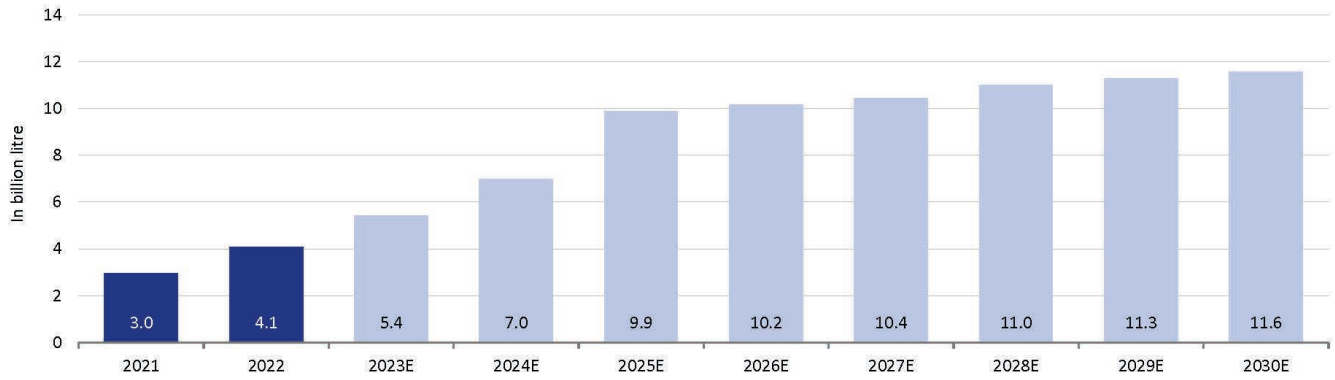
Ethanol Demand-Supply Dynamics

Ramping up supply and pan-India E20 availability important

Demand for ethanol from automobiles to double by 2030

ICRA

Exhibit: Ethanol demand estimates (in billion litre) from the automobile industry



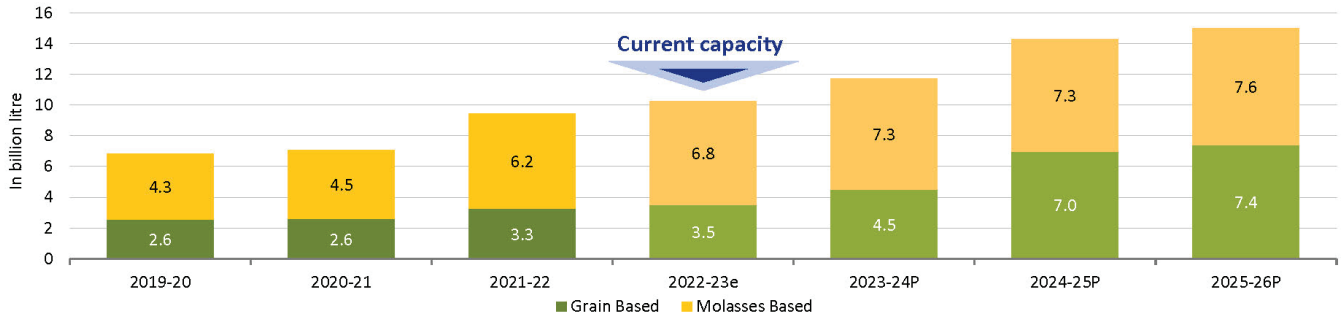
- The demand for ethanol from automobiles is expected to go up as vehicle parc and blending proportion increase. Demand from other applications such as alcobev, chemicals and cosmetics to name a few, would also increase the demand for ethanol further.
- While demand is entirely met from 1G ethanol currently, 1G and 2G ethanol would co-exist going forward.
- India is expected to be one of the larger global markets for ethanol, after the US and Brazil.

Source: Niti Aayog, ICRA Research; 20% ethanol blending rate assumed from 2025

Ability to ramp up capacities remains critical

ICRA

Exhibit: Ethanol capacity requirement (in billion litre, Ethanol supply year)



- To augment supply of ethanol, the Ministry of Environment, Forest and Climate Change, GoI, has approved the green clearance process for grain-based distillery projects until March 31, 2024. This has resulted in faster environmental clearances, with window of 2-3 months from the time of application (was 12-18 months earlier). Further, there is also financial assistance provided in the form of interest subventions of 6% p.a. or 50% of rate of interest charged by banks, whichever is lower, for the loans taken for ethanol projects currently. There are also tripartite agreements being signed between the OMCs, project proponents and banks to ensure that payments from OMCs are utilised for timely debt servicing.
- The GoI has also permitted procurement of ethanol from other non-food feedstock, besides molasses. Investment of Rs. 14,000 crore is in the pipeline to set up 12 biofuel refineries across the country by OMCs, and IOCL has been a front-runner in setting up 2G/3G ethanol plants at Panipat. Capex and opex requirements, are, however, higher in 2G/3G compared to 1G ethanol.

Source: Niti Aayog, Press Information Bureau – Government of India, ICRA Research

Pan-India ethanol availability a must for successful E20 implementation

ICRA



Ethanol Availability

Pan-India ethanol availability and transportation remain critical. Ethanol production is currently concentrated in the sugarcane-producing states of Uttar Pradesh, Karnataka and Maharashtra.

Feedstock Availability

Availability of key raw material (i.e. broken rice for grain-based distilleries), captive power, and water remains critical; raw material availability is also subject to agro climatic risks and any temporary disruptions such as the Food Corporation of India (FCI) recently stopping rice for ethanol production

Demand-supply dynamics

Demand-supply dynamics could influence ethanol prices. In addition, faster than expected adoption of EVs could weaken the demand for petrol and accordingly ethanol.

Source: ICRA Research

Raw material prices on an increasing trend; adequate availability remains critical

ICRA

Exhibit: Indian non basmati rice price trend

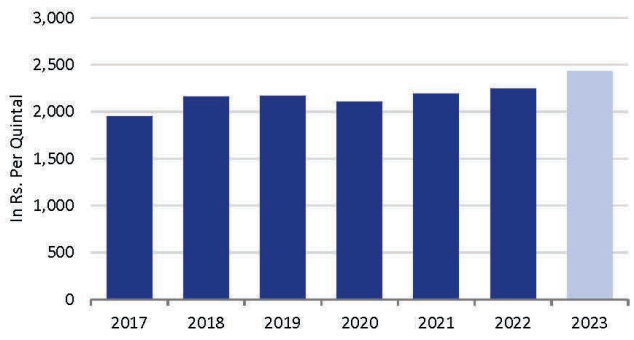
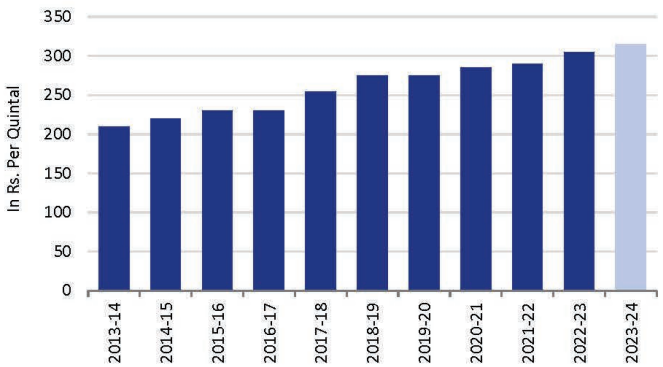


Exhibit: Indian sugarcane price trend (SY)



- At present, rice prices are at a decadal high. Although some moderation in domestic rice prices could be witnessed on account of the export restriction, they are likely to exceed the previous year's levels.
- Also, the highest ever fair and remunerative price (FRP) of sugarcane for season 2023-24 has been approved at Rs. 315 per quintal for the sugarcane farmers.
- Adequate availability of raw material (given the stoppage of rice supply by FCI to ethanol units currently) and compensation of the raw material cost increase in ethanol price remains critical for the ethanol production units.

Source: ICRA Research, CCEA, Bloomberg

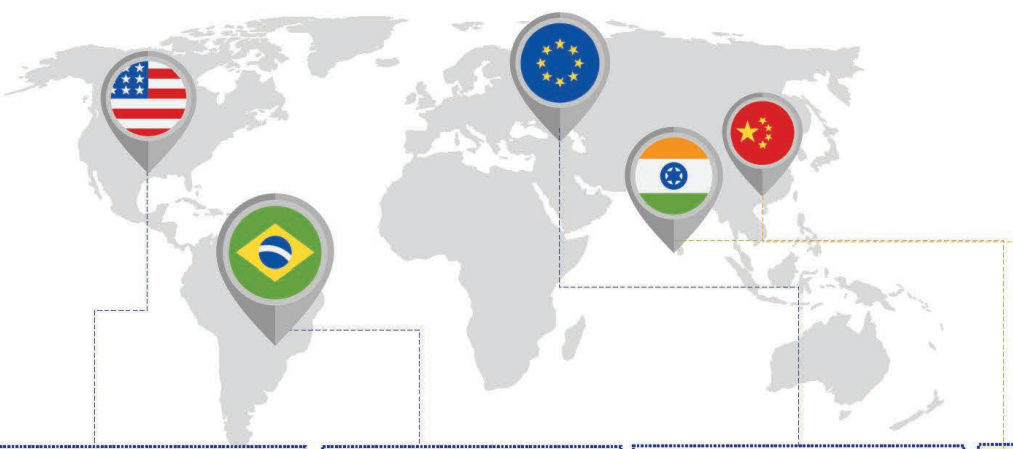


Global Landscape

Brazil has been an early mover in ethanol blending

Different strategies adopted by nations globally to reduce automobile emission

ICRA



China

Chinese automobile market is largely focused on electric vehicles; availability of subsidies, adequate charging infra, local vendor ecosystem and periodic launches of new EV models vis-à-vis gasoline engines to promote EV usage further.

United States of America

Promotion of blended fuels and EVs by the Government to reduce emissions

Brazil

Brazil's focus is on ethanol blending and has multiple flex fuel models available, which account for almost 92% of PV industry sales.

European Union

Electric vehicles have gained popularity in EU because of incentives and availability of charging infrastructure. Plans to move to only electric new vehicles over the medium term.

India

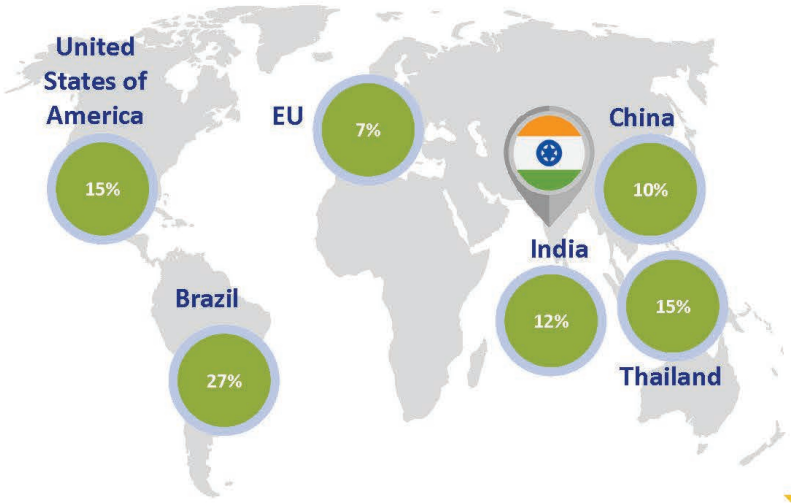
Indian market would have co-existence of EV, CNG vehicles and blended petrol. The policy environment is conducive for promoting both EVs and ethanol blending.

Source: ICRA Research

Brazil remains one of the early movers in ethanol blending

ICRA

Exhibit: Mandates for ethanol blending in different geographies



Brazil's ethanol blending evolution

- **Initial Phase (1975 - 1979)** - Government subsidies include low interest rate loans for sugarcane plantation and new mills
- **Phase II (1979 - 1985)** - Oil price triples, oil deficit reaches peak. Government makes efforts to increase ethanol-based vehicles, resulting in demand for petrol and E100 vehicles
- **Phase III (1986 - 1995)** - Shortage of ethanol due to increase in E100 vehicles sales. Ethanol fuel-injected engine launched. Stops sale of pure petrol, only blended petrol sold
- **Phase IV (1995 - 2000)** - Increase in ethanol blending mandated in the range of 22-24%
- **Phase V (2000 - till date)** – Light vehicle sales rises. Flex fuel vehicles availability and ethanol capacities increase

Source: ICRA Research

Four-pronged approach has made ethanol blending a success story in Brazil

ICRA

Exhibit: Measures undertaken in Brazil to promote ethanol blending



Mass production of high yielding feedstock using modern agri-technologies has created a bio-economy in the country	Confidence on blended fuel availability without challenges	Advancement in vehicle technology – 92% of the light vehicles currently sold in the country are based on flex fuel	Incentives/subsidies to promote adoption of flex fuel vehicles were given in the initial stages.

Source: ICRA Research



Cohesive approach from all stakeholders to facilitate the E20 transition

ICRA

EXHIBIT : Key takeaways

OEMs on track	No major vehicle cost implications	Higher TCO	Pan-India ethanol availability critical	Favourable policy environment
OEM readiness to meet E20 blending norms is unlikely to be a major challenge. While no major capex is envisaged, changes in engine designs and after treatment system apart from material selection will be key to meet norms.	No major design changes are required from a vehicle standpoint except material recalibration. Impact on cost to be less than 1% per passenger vehicle and about 2-3% in the case of 2Ws.	About 6% loss of fuel efficiency is expected as vehicles transition from the E10 to E20-compliant design and this would increase the total cost of ownership (TCO). Further loss of fuel efficiency and corrosion issues in E10 vehicles. OEMs to look at technology upgradation to offset the impact.	Making ethanol available in adequate quantities pan India and addressing portability challenges would be imperative. Ethanol production is currently concentrated in select states such as UP, Karnataka & Maharashtra owing to feedstock availability.	Faster environmental clearances and financial assistance in the form of interest subvention to facilitate capacity addition. Some states have also announced state-level incentives to encourage investments.

Source: ICRA Research

www.icra.in

28



Ethanol blending will help in reducing vehicular emissions

ICRA

Exhibit: Emission reduction potential of ethanol-gasoline blends

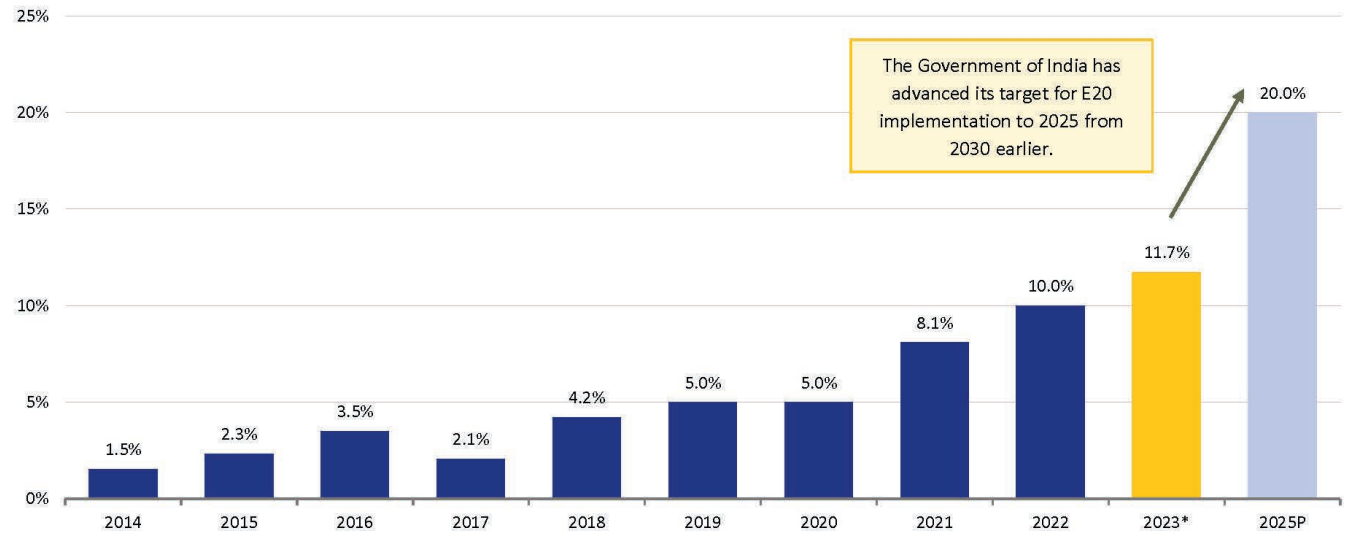
Emissions	Gasoline	Two-wheelers		Four-wheelers	
		E10*	E20*	E10*	E20*
Carbon Monoxide	Baseline	20% lower	50% lower	20% lower	30% lower
Hydrocarbons	Baseline	20% lower	20% lower	20% lower	20% lower
Oxides of nitrogen	Baseline	No significant trend	10% higher	No significant trend	Same

*Source: Niti Aayog, ICRA Research; * E10 project was carried out in FY2010 while E20 project was carried out in FY2015, with different test vehicles*

Progressive rise in pan-India ethanol blending rates

ICRA

Exhibit: Trend in pan-India ethanol blending – Past & Projected



*Source: PPAC, Niti Aayog, ICRA Research; * Ethanol blending with Petrol was 12% during June 2023 and cumulative ethanol blending during December 2022- June 2023 was 11.74%.*

Meaningful adoption of flex fuel vehicles still some time away

ICRA

Exhibit: Challenges with adoption of flex fuel vehicles



Significant technology and design changes will be required, resulting in higher investment and vehicle costs. Further, ethanol availability will have to ramp up substantially, raising concerns on food security and feed-stock availability.

It is estimated that the running cost of flex fuel-based vehicles will be approximately higher by 30% compared to gasoline vehicles owing to lower fuel efficiency.

Limited flex fuel models are available at present. The OEMs have started developing models at pilot scale. Flex fuel Wagon R has been showcased while Toyota has launched a project flex fuel-based hybrid EVs.

Source: ICRA Research

ICRA Analytical Contact Details

Name	Designation	Email	Contact Number
Shamsher Dewan	Senior Vice-President and Group Head	shamsherd@icraindia.com	0124 – 4545 328
Srikumar K	Senior Vice-President and Co-Group Head	ksrikumar@icraindia.com	044 – 4596 4318
Vinutaa S	Vice-President and Sector Head	vinutaa.s@icraindia.com	044 – 4596 4305

ICRA Business Development/Media Contact Details

Name	Designation	Email	Contact Number
L Shivakumar	Chief Business Officer	shivakumar@icraindia.com	022-61693304
Neha Agarwal	Head – Research Sales	neha.agarwal@icraindia.com	022-61693377
Rohit Gupta	Head Business Development - Infrastructure Sector	rohitg@icraindia.com	0124-4545340
Vivek Bhalla	Head Business Development - Financial Sector	vivek.bhalla@icraindia.com	022-61693372
Vipin Saboo	Head Business Development – Corporate Sector - West & East	vipin.saboo@icraindia.com	022-61693348
Shivam Bhatia	Head Business Development – Corporate Sector - North & South	shivam.bhatia@icraindia.com	0124-4545803
Naznin Prodhani	Head – Media & Communications	communications@icraindia.com	0124-4545860

ICRA



© Copyright, 2023 ICRA Limited. All Rights Reserved.

All information contained herein has been obtained by ICRA from sources believed by it to be accurate and reliable. Although reasonable care has been taken to ensure that the information herein is true, such information is provided 'as is' without any warranty of any kind, and ICRA in particular, makes no representation or warranty, express or implied, as to the accuracy, timeliness or completeness of any such information. Also, ICRA or any of its group companies, while publishing or otherwise disseminating other reports may have presented data, analyses and/or opinions that may be inconsistent with the data, analyses and/or opinions in this publication. All information contained herein must be construed solely as statements of opinion, and ICRA shall not be liable for any losses incurred by users from any use of this publication or its contents.

ICRA

Thank You!

What Drives Auto Demand: Macro-Consumer-Industry Based Study- Automobile and Components Forecasting

by

Sanathana


Sanathana
Analytics And Recruitment Services
ACMA ANNUAL CONVENTION
2023
WHAT DRIVES AUTO DEMAND
MACRO- CONSUMER-INDSUTRY BASED STUDY
AUTOMOBILE AND COMPONENTS FORECASTING


Sanathana
TABLE OF CONTENTS
• Framework
• Role of the 3 drivers in demand
• Forecasting of automobiles and components
• About Sanathana

Sanathana



Higher interest rates hurting car buyers' sentiment, hints SIAM

The Society of Indian Automobile Manufacturers (SIAM) has just published the vehicle sales data for Nove 2022. The data shows that the passenger vehicle segment has posted its highest-ever sales in the current financial year till November, with 276,231 units sold. However, there are concerns bothering vehicle buye

Study: India's GDP growth impact on Passenger Vehicle market!

Passenger vehicle mass-market *recession is triggered when India's GDP growth hovers around 5%. A GDP growth rate of less than 4% in the Indian economy has always resulted i*

THE ECONOMIC TIMES | Industry

English Edition ▾ | 28 August, 2023, 02:55 PM IST | Today's Paper

Auto sales point to distress in rural India even

Demand strong but inflation, commodity prices could impact growth, says Shashank Srivastava

Price hikes by Maruti Suzuki and other companies have not been enough to offset the rally in commodity prices, says Shashank Srivastava, senior executive director, Marketing & Sales, Maruti

Home › News › Two-wheeler dealers hang hopes on wedding season sales

Two-wheeler dealers hang hopes on wedding season sales

Industry analysts think that the current wedding season is likely to see a higher offtake as compared to the April-March wedding season.

By Amit Vijay M | 04 Nov 2022 | 8004 Views | Share -

WHAT DRIVES INDIAN AUTO INDUSTRY?

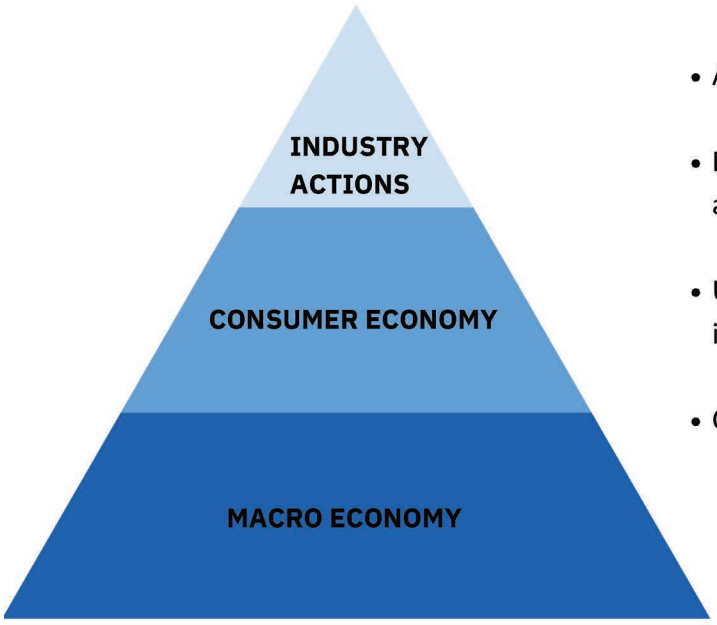
Some key questions the study aims to answer:

1. How do we understand and categorise all the factors that drive automobile demand?
2. What is the role of macro-economic factors on automobile demand?
3. How does customer economic status affect automobile demand?
4. What is the role of industry-specific actions like inventory, insurance cost, marriage days on automobile sales?

3

Sanathana

3000 VARIABLES TO 3 CORE DRIVERS



AUTO INDUSTRY DEMAND PYRAMID

- Analyzed 3,300+ variables from diverse sources.
- Narrowed down to 254 variables with direct impact on auto demand.
- Utilized Random Forest machine learning for detailed insights.
- Categorized 254 variables into:
  i. Macro Economy
  ii. Consumer Economy
  iii. Industry Specific Actions

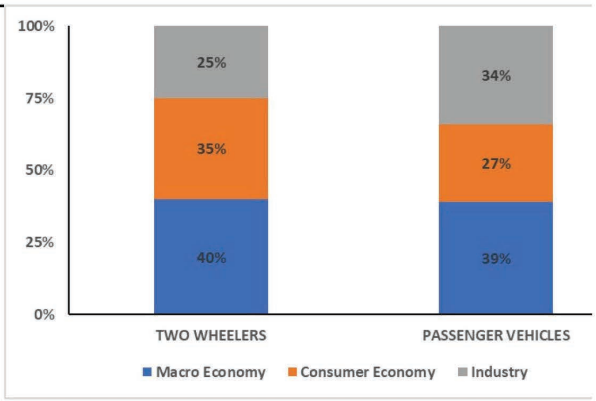
4

Sanathana

ROLE OF 3 DRIVERS IN PV AND TW DEMAND

KEY INSIGHTS :

- Macroeconomy affects around 40% of demand in two-wheelers and Passenger vehicles
- Consumer economy appears to affect two-wheeler demand more than demand for passenger vehicles. 35% in TWs vs 27% in PVs.
- Industry-specific factors appear to affect pv demand more than two-wheeler demand. 25% in TWs vs 34% in PVs.

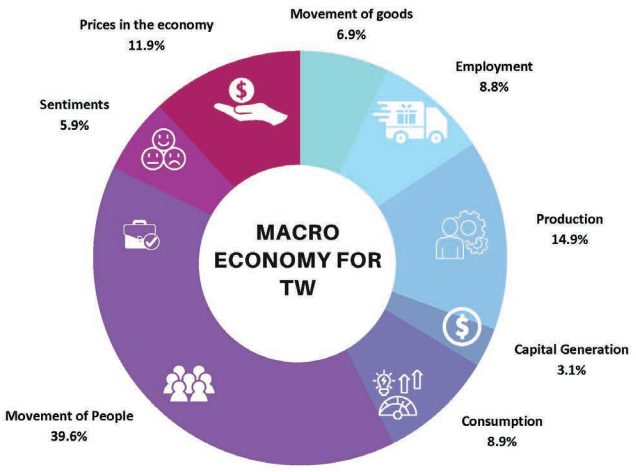


SOURCE: SANATHANA RESEARCH

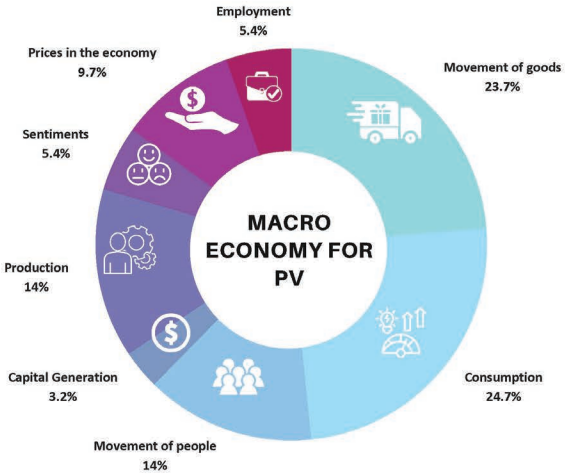
5

Sanathana

TW MACRO DRIVERS



PV MACRO DRIVERS



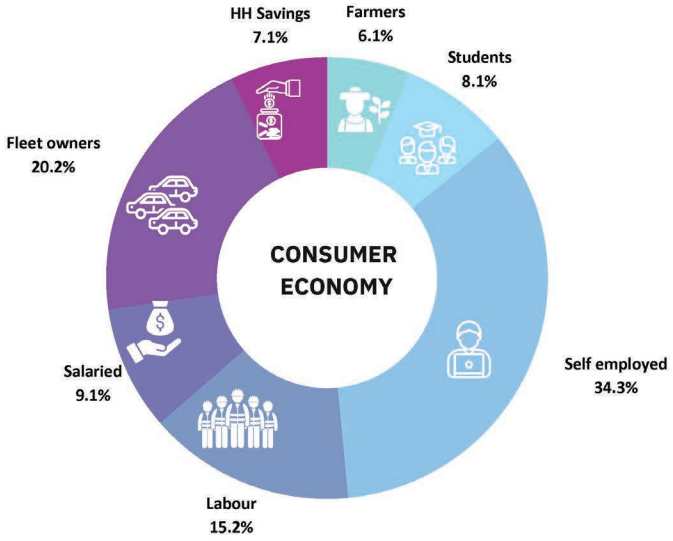
- The impact of the Macro Economy is measured through 8 factors.
- Mobility of People, Production, Employment, and Prices in the economy affect TW demand more than PV demand.
- Consumption in the Economy affects demand for PV more than TW.
- Sentiments and Capital have similar effects on PV and TW.

SOURCE: MOSPI,RBI, SANATHANA RESEARCH

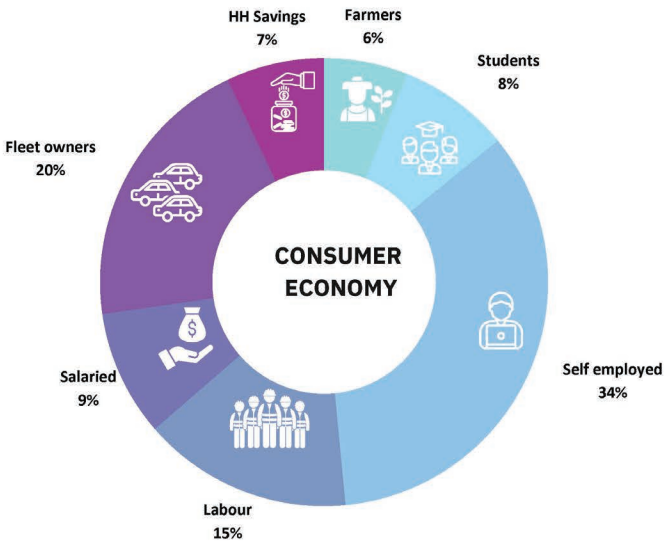
6

Sanathana

TW CONSUMER DRIVERS



PV CONSUMER DRIVERS



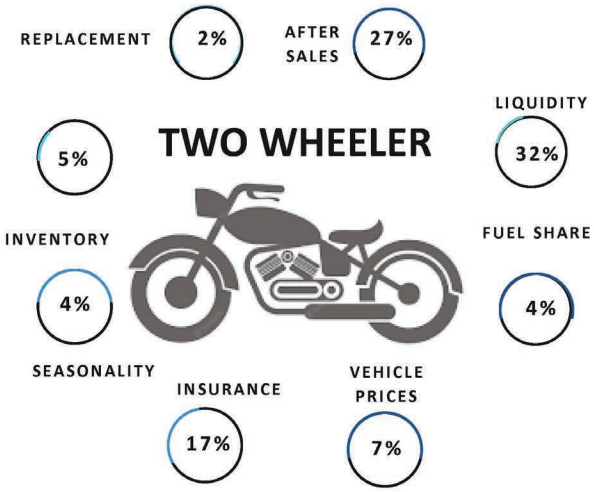
- THE impact of the Consumer Economy is measured THROUGH 7 factors.
- Household Savings, Economic health of - Fleet Owners, Salaried, Labour, Self-employed, Students and Farmers have a similar effect on PVs and TWs.

SOURCE: MOSPI, SANATHANA RESEARCH

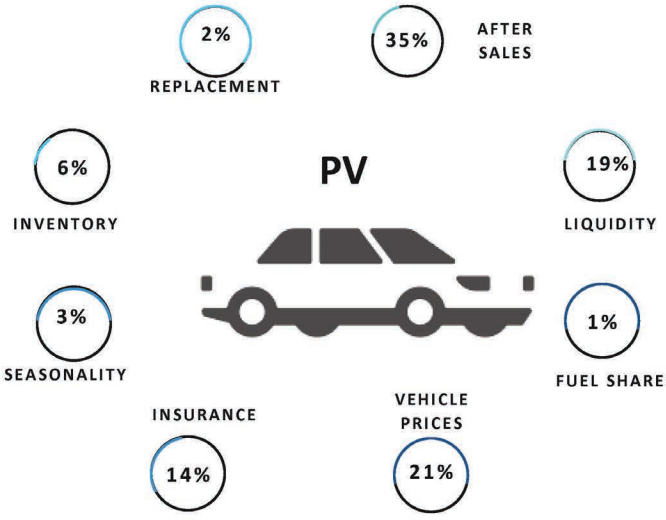
7

Sanathana

TW - INDUSTRY DRIVERS



PV - INDUSTRY DRIVERS



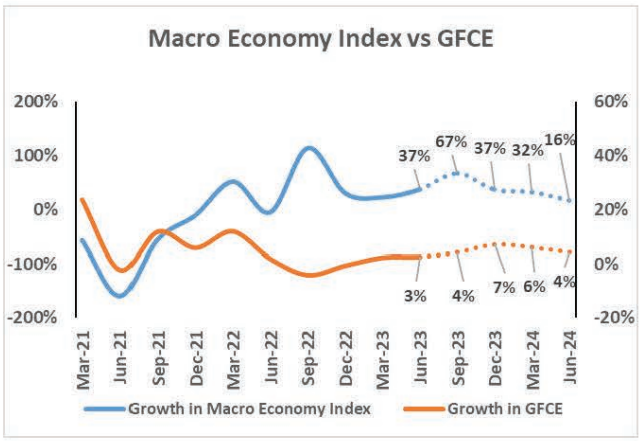
- The impact of INDUSTRY-SPECIFIC ACTIONS is measured through 8 factors.
- Insurance, EV Share, Liquidity affect TW demand more than PV demand.
- After Sales, Vehicle prices affect PV demand more than TW demand.
- Replacement, Inventory, and Seasonality appear to have a similar effect.

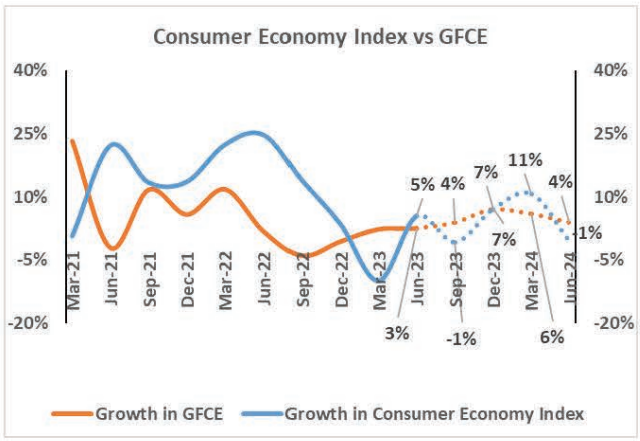
SOURCE: VAHAN, SANATHANA RESEARCH

8

Sanathana

FORECAST OF MACRO AND CONSUMER INDICES





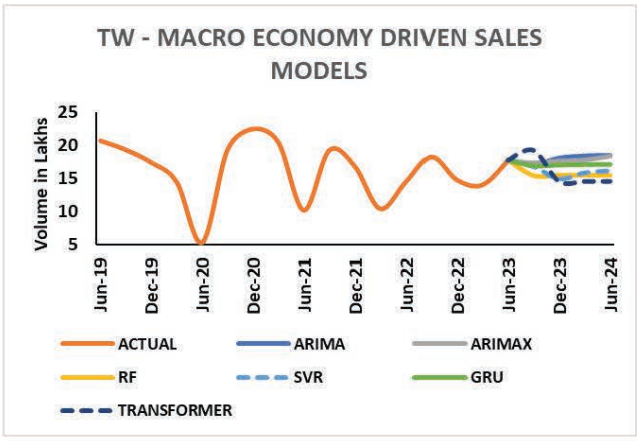
- 185 forward-looking variables were evaluated.
- 9 Macro variables with reliable forecasts were selected.
- Government Expenditure was selected due to its causal significance.
- Over the next four quarter Macro index is likely to grow by 30% and Consumer index by 5%.

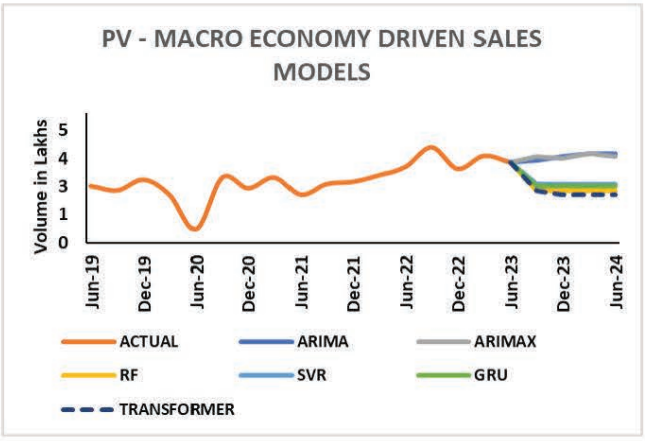
SOURCE: MOSPI, SANATHANA RESEARCH

9

Sanathana

FORECAST OF TW AND PV MACRO SALES





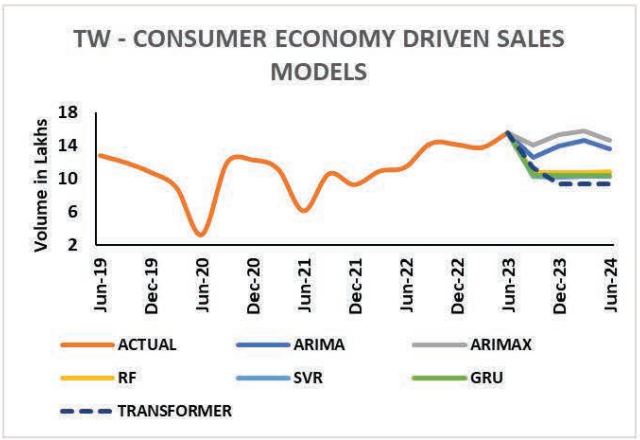
- Macroeconomy-driven sales were estimated using 7 models.
- 3 models for TWs and 2 models for PVs indicate a steady state of sales over the next four quarters.
- 1 model for TWs and 3 models for PVs indicate a step-down growth from Dec-23 due to the macroeconomic scenario.
- Models suggest around 40% to 43% of the total sales will be driven by the macroeconomy over the next four months.

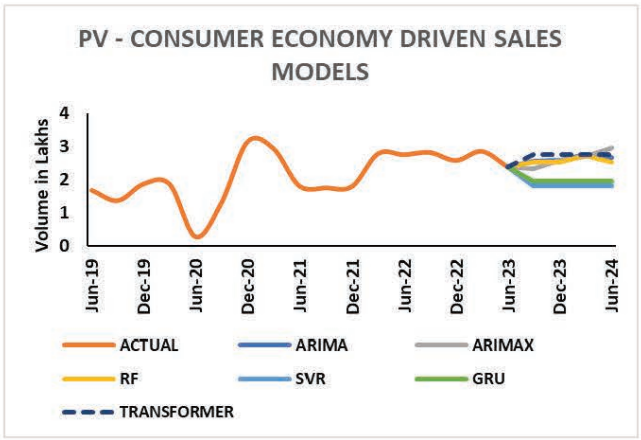
SOURCE: MOSPI, SANATHANA RESEARCH

10

Sanathana

FORECAST OF TW AND PV CONSUMER SALES





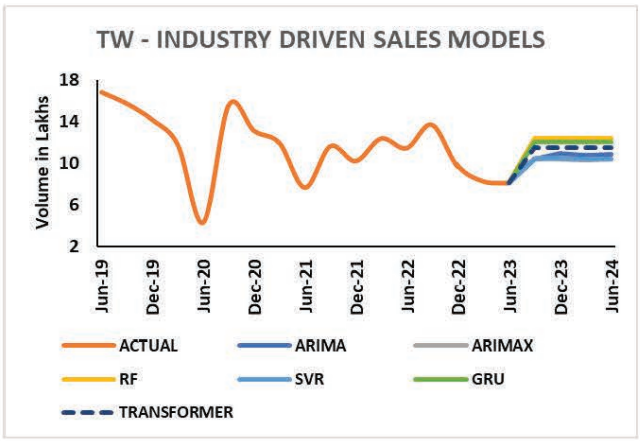
- Consumer economy-driven sales were estimated using 7 models.
- All the models suggest a fall in consumer economy-driven sales till Sep 23 for TWs. For PVs, only 2 models suggest this.
- 2 models for TWs and 3 models for PVs suggest a revival from Dec 23.
- Models suggest around 32% to 38% of the total sales will be driven by consumer economy over the next four months.

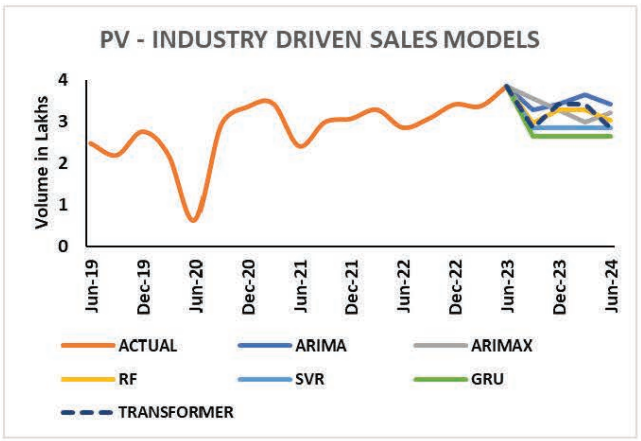
SOURCE: MOSPI, SANATHANA RESEARCH

11

Sanathana

FORECAST OF TW AND PV INDUSTRY-ACTION DRIVEN SALES





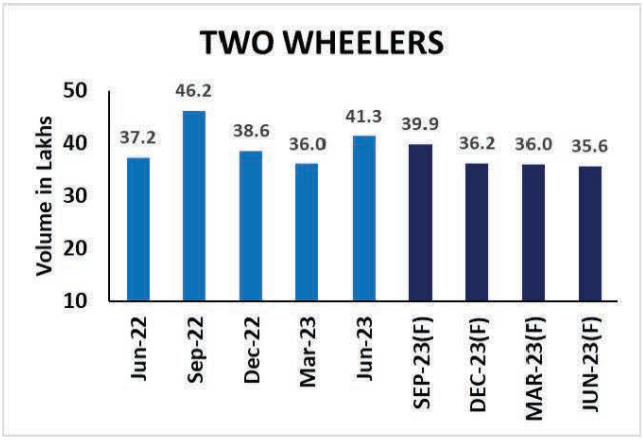
- Sales driven by Industry Actions were estimated using 7 models.
- For TWs all the models suggest a strong Step Up styled pick up in sales from Sep 23. For PVs on the contrary all the models suggest a fall in Sales till Sep 23.
- 2 models indicate a revival in PV sales from Dec 23 till Mar 23.
- Models suggest around 20% to 25% of the total sales will be driven by industry-specific actions over the next four months.

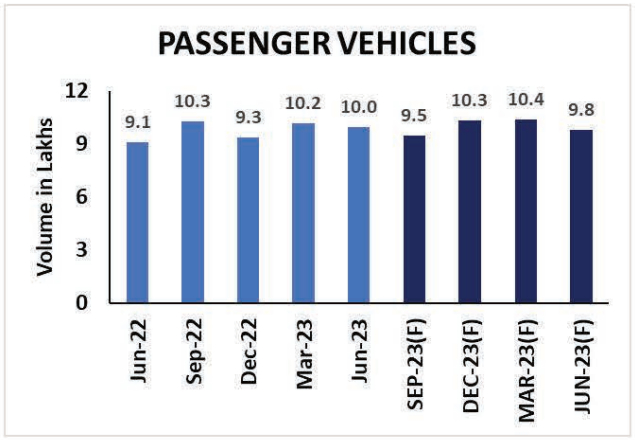
SOURCE: MOSPI, SANATHANA RESEARCH

12

Sanathana

FORECAST OF TOTAL TW AND PV SALES



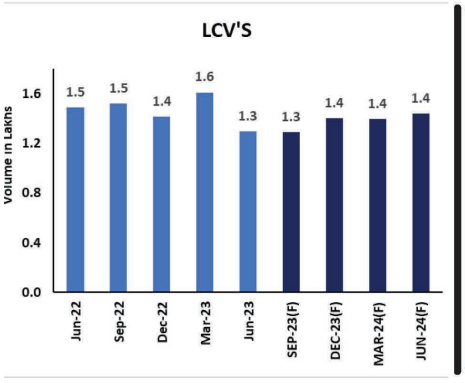


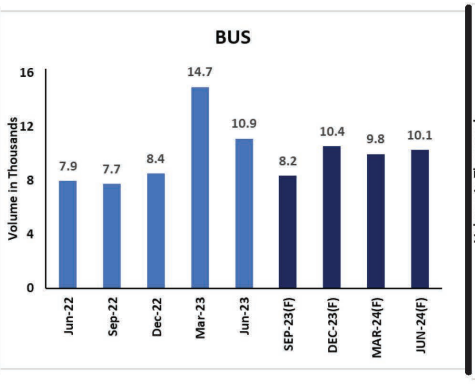
- Final Output is derived through ensemble modelling technique.
- A four-quarter forecast is presented.
- Ensemble model output indicates that TW is likely to experience a decline in Q2FY 24 and then grow thereafter.
- PV's are likely to experience a steady growth over the next four quarters.

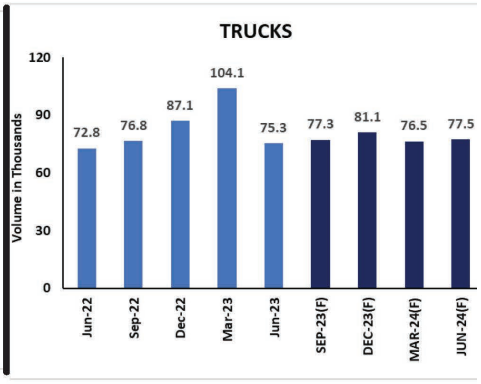
SOURCE: SIAM, SANATHANA RESEARCH 13

Sanathana

FORECAST OF LCV, BUS and TRUCK SALES





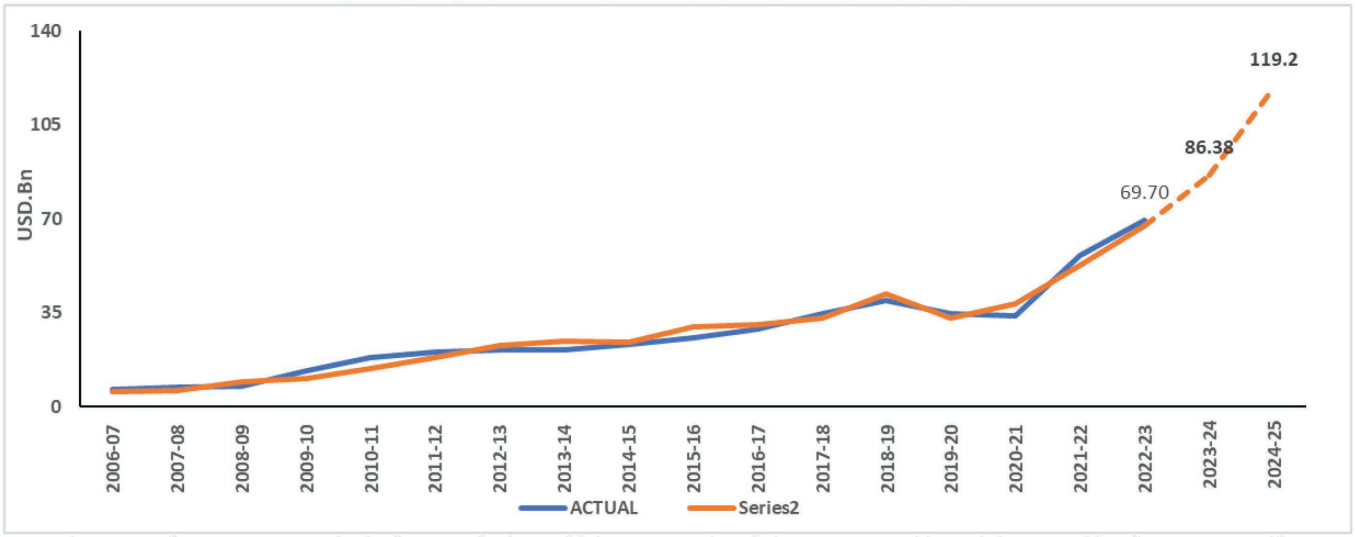


- A similar forecasting methodology presented before was adopted even for forecasting commercial vehicles.
- For CVs, macro economy drives around 49% of sales, consumer economy drives around 29% of sales and industry actions drive 22% of sales.
- Ensemble model output indicates that LCVs are likely to experience similar volumes in next four quarters.
- Trucks are likely to grow in the next quarter and experience a marginal slow down thereafter.
- Buses are likely to grow in the next two quarters.

SOURCE: SIAM, SANATHANA RESEARCH 14

Sanathana

AUTO COMPONENTS TURNOVER



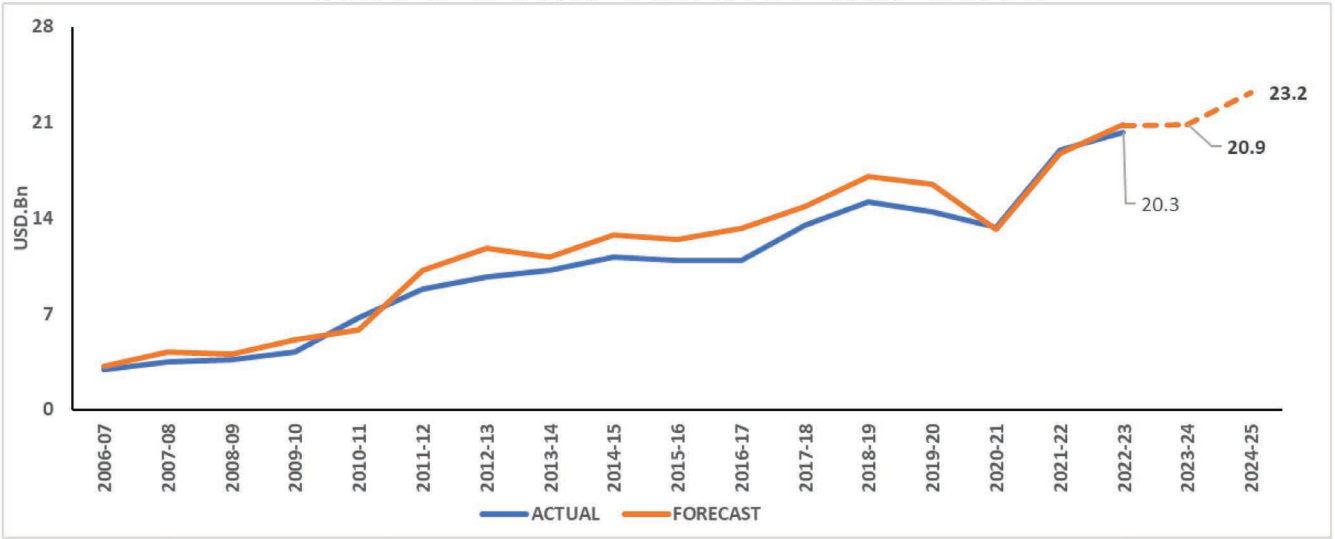
- Annual turnover of auto components is also forecasted using multiple econometric techniques. An ensemble model output with reference to actual is presented above.
- Total GDP, inflation, industry GDP and trend variables are considered. GDP (current) is estimated at 12.4% in FY24 and 13.5% in FY25. Inflation is assumed at 5.40% in FY24 and 5.90% in FY25. Industry is assumed at 11.2% in FY24 and 13.4% in FY25.
- Based on the above auto components turnover is likely to grow by 36% in FY24 and 39% in FY25.

SOURCE: ACMA, SANATHANA RESEARCH

15

Sanathana

AUTO COMPONENTS IMPORTS



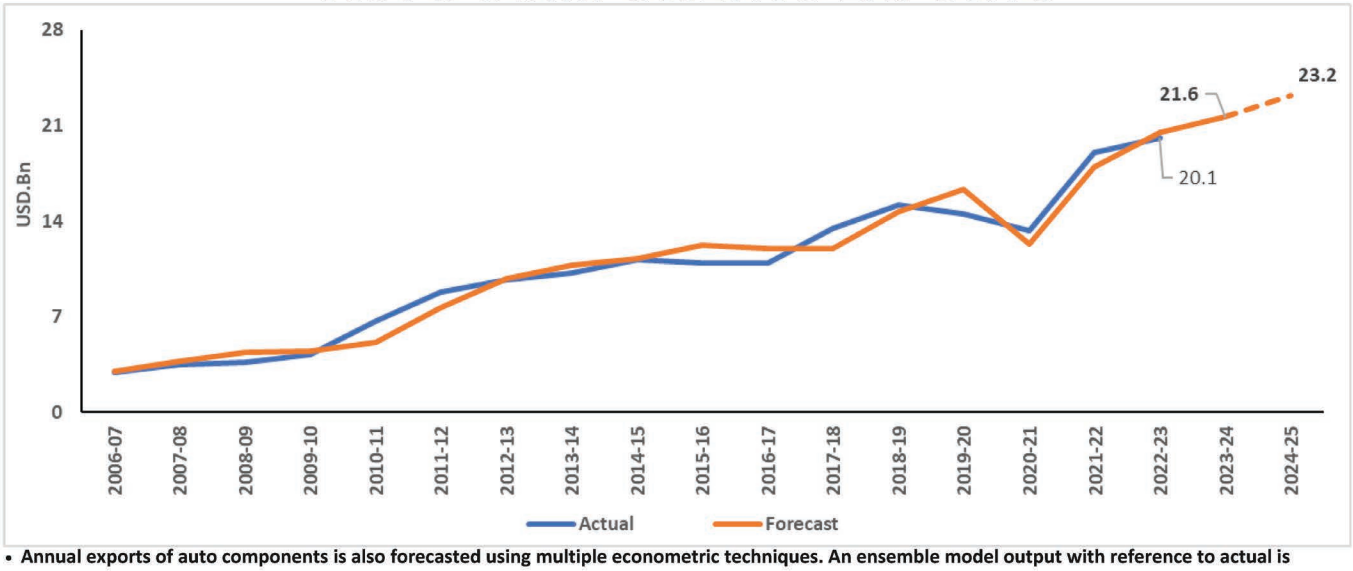
- Annual imports of auto components is also forecasted using multiple econometric techniques. An ensemble model output with reference to actual is presented above.
- Total import, inflation and trend variables are considered. Total imports are estimated to grow by 3.5% in FY24 and 12.5% in FY25. Inflation is assumed at 5.40% in FY24 and 5.90% in FY25.
- Based on the above auto components imports are likely to grow by 3% in FY24 and 11% in FY25.

SOURCE: ACMA, SANATHANA RESEARCH

16

Sanathana

AUTO COMPONENTS EXPORTS



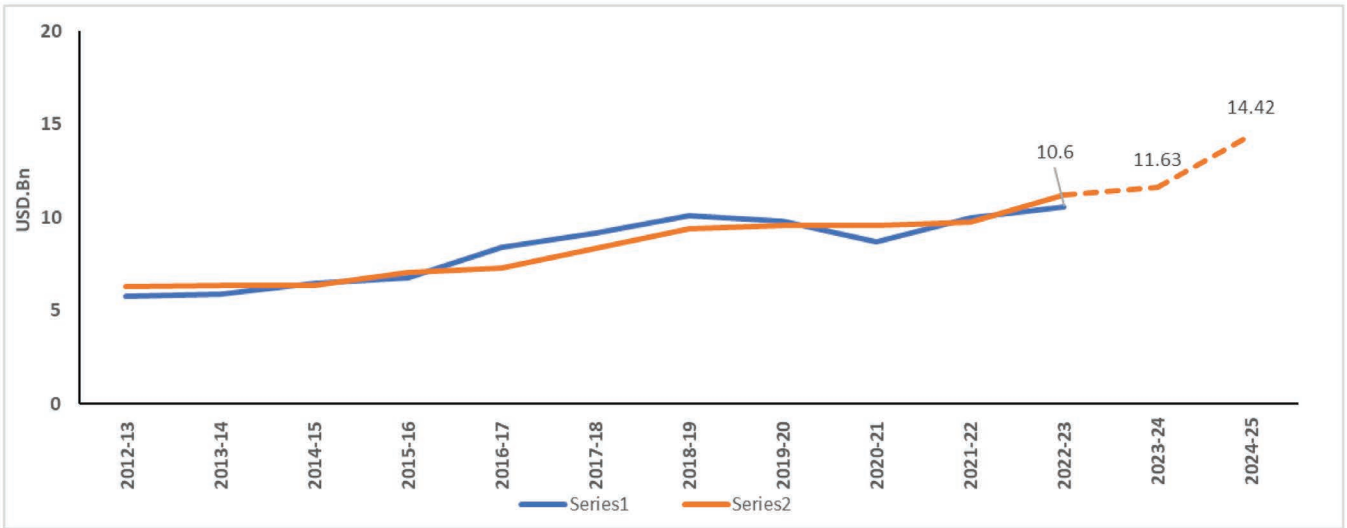
- Annual exports of auto components is also forecasted using multiple econometric techniques. An ensemble model output with reference to actual is presented above.
- Total exports, inflation and trend variables are considered. Total exports are assumed at 3% in FY24 and 11.5% in FY25. Inflation is assumed at 5.40% in FY24 and 5.90% in FY25.
- Based on the above auto components exports is likely grow by 7% in FY24 and 7% in FY25.

SOURCE: ACMA, SANATHANA RESEARCH

17

Sanathana

AUTO COMPONENTS AFTER MARKET



- Annual aftermarket of auto components is also forecasted using multiple econometric techniques. An ensemble model output with reference to actual is presented above.
- Industry GDP, inflation and trend variables are considered. Industry GDP (current) is estimated at 5.80% in FY24 and 7.50% in FY25. Inflation is assumed at 11.2% in FY24 and 13.4% in FY25.
- Based on the above auto components aftermarket are assumed at 4% in FY24 and 24% in FY25.

SOURCE: ACMA, SANATHANA RESEARCH

18

Sanathana

SANATHANA RESEARCH TEAM



Y. Sri Ranganatha Raju
Director
ranganatharaju@sanathanaars.com



A.Raj kumar
Data Analyst



MD.Abdul Aleem
Data Scientist
aleem@sanathanaars.com
+91 9160206658



M. Sai Manisha
Analyst



A.Akanksha
Economist
akanksha@sanathanaars.com



S.Sandeep
Analyst

Sanathana **SANATHANA IS A RURAL TECH COMPANY WITH A 100 TEAM. STARTED IN 2017**

NATIONAL MEDIA RECOGNISES SANATHANA

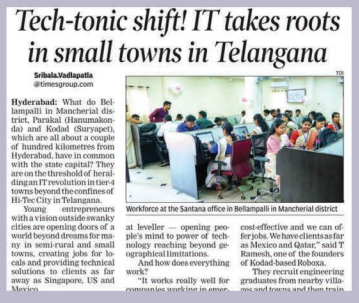


IT revolution breaks confines of Hyd, moves to tier-4 towns

Cos Hire Top Coders From Hyd & B'luru

UNTAPPED TALENT IN RURAL AREAS

Young entrepreneurs creating jobs for locals in tier-4 towns of Telangana & providing technical solutions



Tech-tonic shift! IT takes roots in small towns in Telangana

Sribala.Vadlapatla
@timesgroup.com

Hyderabad: What do Bellampalli in Mancherial district, Parakal (Hanumakonda) and Kodad (Suryapet), which are all about a couple of hundred kilometres from Hyderabad, have in common with the state capital? They are on the threshold of heralding an IT revolution in tier-4 towns beyond the confines of Hi-Tec City in Telangana.

Young entrepreneurs with a vision outside swanky cities are opening doors of a world beyond dreams for many in semi-rural and small towns, creating jobs for locals and providing technical solutions to clients as far away as Singapore, US and Mexico.

Workforce at the Santana office in Bellampalli in Mancherial district

at leveller — opening people's mind to power of technology reaching beyond geographical limitations.

And how does everything work?

"It works really well for companies working in open, cost-effective and we can offer jobs. We have clients as far as Mexico and Qatar," said T Ramesh, one of the founders of Kodad-based Roboxa.

They recruit engineering graduates from nearby villages and towns and then train

Sanathana

TELANGANA GOVT RECOGNISING SANATHANA IN STATE ASSEMBLY ON 6TH AUG 2023



TELANGANA GOVT SHOWCASING SANATHANA AS EXEMPLARY RURAL TECH IN USA CEO FORUM



TELANGANA IT MINISTER KTR APPRECIATING SANATHANA




Sanathana
Analytics And Recruitment Services
THANK YOU

Advertisement of Sponsors

ACMA

Automotive Component Manufacturers Association of India

63rd Annual Session - 'Mobility 360° - Sustainability For Cometitiveness'

September 13, 2022

Thank You Sponsors

Registration Zone Partner

ROSMERTA
Technologies Limited

DRIVING INNOVATION, CONNECTING FUTURES

ROSMERTA
Technologies Limited



ROSMERTA'S INTEGRATED MOBILITY SOLUTIONS

IDENTIFICATION
High Security Registration Plates (HSRP), Smart Card Based DL+RC Solutions, Microdots

COMPLIANCE SERVICES
Automated Testing Stations (ATS), Automated Driving Testing Tracks (ADTT), RTO Services

CONNECTED ELECTRONICS
IOT/M2M Connectivity Solutions, Telematics Solutions (VTS, SLD)

VEHICLE CARE
Repairs & Servicing, AI Inspection, Vehicle Accessories, Insurance & Vehicle Services

SUSTAINABILITY
Registered Vehicle Scrapping Facility (RVSF), Diesel Exhaust Fluid (DEF), Pollution Under Control (PUC)

CONTACT

+911244990800
www.rosmertatech.com
Rosmerta Technologies Limited,
Plot No.66, Phase -1, Sector 44,
Gurugram, Haryana 122001

ACMA

Automotive Component Manufacturers Association of India

63rd Annual Session - 'Mobility 360° - Sustainability For Cometitiveness'

September 13, 2022

Thank You Sponsors

Audio - Visual Logistics

BAPL rototech

Welspun BAPL

WELSPUN GROUP COMPANIES



BAPL rototech

We help to create a green & beautiful World with Proven & Patented Solutions.
We focus on Customer Delight with Enhancing Cabin Comforts, Engaging Exterior Aesthetics and Innovative Fluid & Energy Storage solutions.

40 years | 6 Countries | 36 OEM's | 1320 Products

Interior : Instrument Panel, Door Trims, Floor Console, Roof Console

Exteriors : Bumpers, Grills, Cowls, Painted Body Parts, Mudguards

Fuel & Energy Storage : Fuel Tanks, AdBlue Tanks, CNG & H2 Type 4 Tanks

Functional : Airducts, Snorkels, Toolboxes, Canopy








Personal Vehicles | Commercial Vehicles | Farm & Construction Equipment's | Industrial

India | Italy | France | China | Russia | Brazil

Corporate Address : Welspun House, 7th Floor, Kamala Mills Compound, Senapati Bapat Marg, Lower Parel, Mumbai 400 013, India.

India Locations : Gurgaon | Jamshedpur | Pithampur | Pune | Chennai | Hosur

www.welspunbapl.com | www.baplrototech.com | www.rototech.it

Welspun BAPL | rototech group

AN INDO ITALIAN JOINT VENTURE COMPANY

ACMA

Automotive Component Manufacturers Association of India

63rd Annual Session - 'Mobility 360° - Sustainability For Cometitiveness'

September 13, 2022

Thank You Sponsors

Platinum Sponsors

AIP Abilities India Pistons & Rings Ltd. Quality | Engagement | Innovation PISTONS & RINGS

ANAND

AIS Asahi India Glass Ltd.

BHARAT FORGE KALYANI

JBM Group Our milestones are touchstones

JK Fenner

UPS LAKSHMI LPS BOSSARD Proven Productivity

nbc flexible solutions

CK BIRLA GROUP

NEOLITE AUTOMOBILE LIGHTING

SAFEXPRESS THE COMPLETE LOGISTICS SOLUTIONS Distribution Redefined

SONA COMSTAR

Subros Cooling the Planet

SUNFLAG STEEL

UNO MINDA DRIVING THE NEW

varroc EXCELLENCE

ZUMEN

AIP®
PISTONS & RINGS

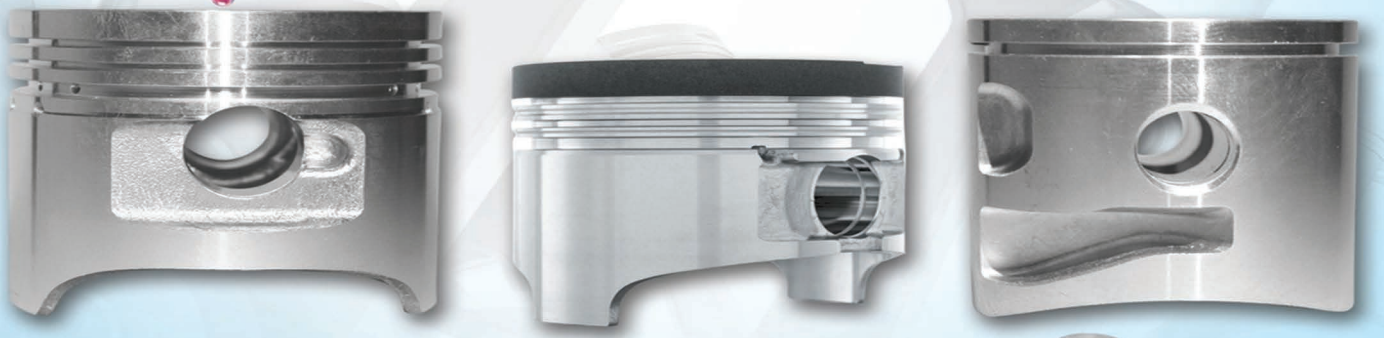
Abilities India Pistons & Rings Ltd.

Quality | Engagement | Innovation

ABILITIES BENCHMARKED









NIKASIL
Coated Cylinders for Railway / Metro Train



NIKASIL
Coated Cylinder for Power Bike

Our valued OEM customers

MARUTI SUZUKI · HONDA · YAMAHA · TVS · HONDA POWER PRODUCTS · Husqvarna · STIHL · StanleyBlack&Decker · Emak · KNORR BREMSE · ZENOAH · Wabtec

Abilities India Pistons & Rings Limited

G.T. Road, Giani Border, P.O. Chikamberpur, Ghaziabad – 201006 (UP) INDIA

Phone: +91-120-4623761 Email : aip@aippistons.net Website: www.aippistons.com



ACYM ANCHEMCO ANEVOLVE ANSYSCO CYMyutec DANA FORVIA faurecia GABRIEL Haldex

Henkel HL Mando inalfa roof systems iPOWER JOYSON SAFETY SYSTEMS MAHLE SUJÁN Valeo SNS Foundation

www.anandgroupindia.com



AIS Auto Glass

AIS Dark Green UV Cut Glass

The perfect solution for thermal control

Explore the green future of mobility with our revolutionary sustainable solutions

AIS Dark Green UV Cut Glass protects passengers from UV rays and provides thermal comfort. It can be used in combination with the AIS IR Shield Windshield and the AIS Solar Shield Backlite for complete protection.



AIS IR Shield®
IR Cut Windshield

AIS IR+UV Shield®
Dark Green UV Cut Sidelite

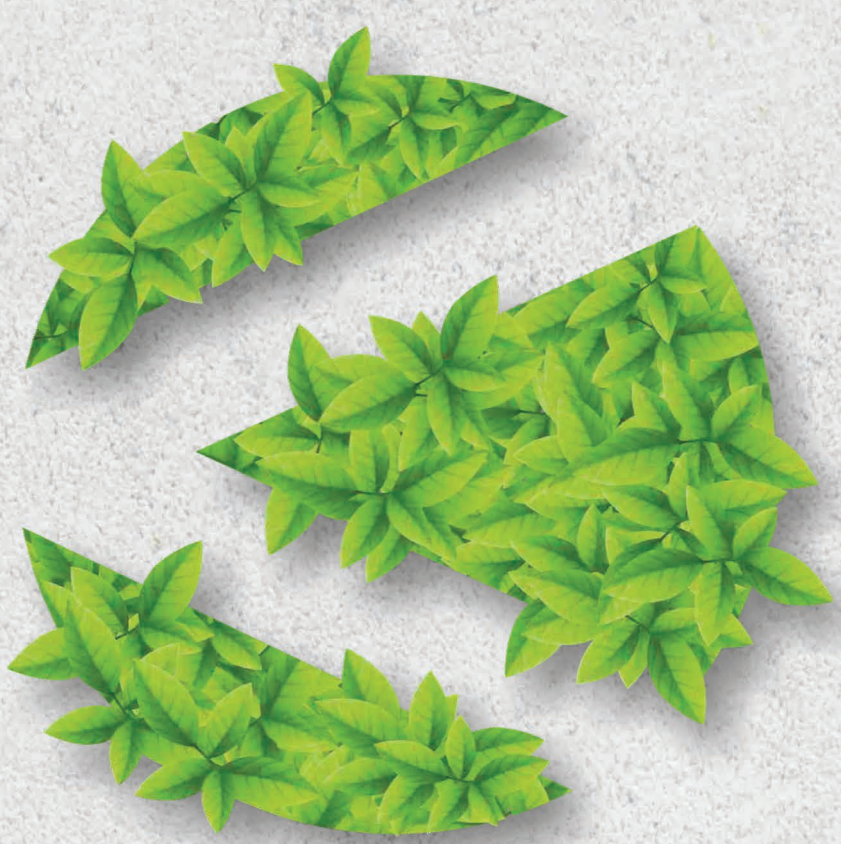
AIS Solar Shield®
Solar Control Backlite

- Improves passenger comfort by blocking heat and reducing cabin temperature
- Reduces the load on the A/C thus leading to improved vehicle fuel economy and lower CO_2 emissions
- Enhances the life of car interiors and is aesthetically appealing
- Lowers light transmission up to 56% against 82% in normal green glass as per Central Motor Vehicle Rules*
- Blocks UV rays by 82% versus 68% in normal green glass (3.2 mm thickness)
- Offered by OEMs as a factory-fitted solution
- Delivers longer life and effectiveness as compared to car films

To know more, scan the QR code



*As per ARAI Certification IS 2553.



You see Metal, we see GREEN!

BHARAT FORGE | KALYANI

stepping towards a **sustainable** tomorrow

With 50 years of experience, the Kalyani Group is the largest collection of metallurgical know-how, design and engineering knowledge, and manufacturing prowess in the region. The cornerstone of our success has been developing our own technology, constantly improving our technical processes, and continuously training our workforce to create a talent factory. As an agile-focussed company we empower sustainable solutions for modern India as **Reduce.Reuse.Recycle** is a mantra we follow.

Bharat Forge Limited, Mundhwa, Pune - 411036, India, Tel: **+91-20-67042777**
Fax: **+91-20-26822387** | Email: **info@bharatforge.com** | Website: **www.bharatforge.com**

e-VERSE

JBM Group
Our milestones are touchstones

UNLEASH THE POWER OF ELECTRIC MOBILITY WITH JBM ELECTRIC BUSES



DEDICATED TO SUSTAINABILITY AND COMMUNITY WELL-BEING

Follow us on:

AUTOMOTIVE I BUSES & ELECTRIC VEHICLES | EV AGGREGATES |
RENEWABLES | ENVIRONMENT MANAGEMENT I AI & IND 4.0

MAKE IN INDIA

JKF EVOLVE

2W EV Product Solutions


Traction CVT System


Hub Motor


Mid Drive Motor


Rubber & Steel Braided cables

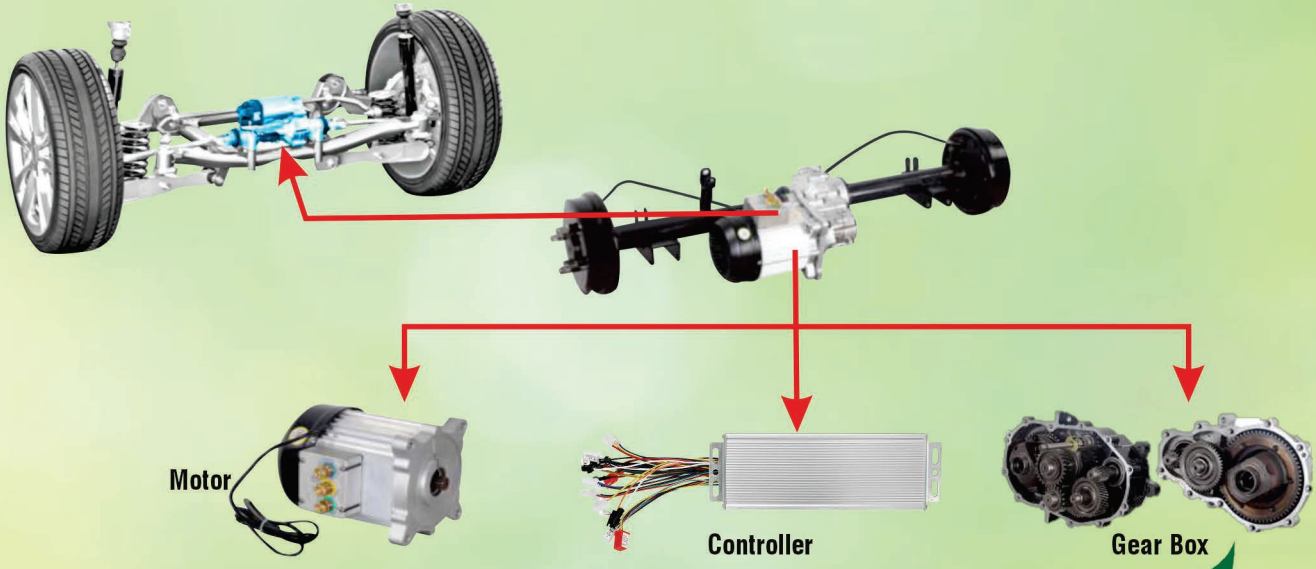

Transmission Seals


Wheel Hub Seals


Fork Seals


Moulded Rubber Parts

3W/LCV E-Axle Solutions



Light Weight Solutions


Drive Covers


Swing arm & Fork Components


Composite Leaf Spring

JKF Evolve

JKF Evolve Limited
(Subsidiary of J.K. Fenner (India) Limited)
Factory : Sipcot Industrial Complex, Nilakottai, Pallapatty, Nilakottai, Nilakottai Industrial Park, Dindigul, Tamil Nadu, 624201
Registered Office: 3, Madurai - Melakkal Road, Kochadai, Madurai - 625 016.
+91 452 - 4283800 filmdu@jkfenner.com

MEMBER J.K.ORGANISATION

UPS LAKSHMI

LPS BOSSARD

Proven Productivity



THE TRUSTED EXPERT BRAND

Providing Assembly Technology Solutions Globally

OUR FASTENERS USED ACROSS VARIOUS INDUSTRIES

- AUTO/EV
- MEDICAL
- RAILWAYS AND METRO
- DIE AND MOULD
- POWER TRANSMISSION AND DISTRIBUTION
- RENEWABLE ENERGY
- AEROSPACE AND DEFENCE
- CONSTRUCTION EQUIPMENTS

Certifications

ISO 9001 : 2015 | IATF 16949 : 2016 | ISO 14001 : 2015 | BS OHSAS 18001 : 2007 | AS 9100D

NADCAP HEAT TREATMENT | NADCAP NDT | NADCAP MPI | NABL ISO/IEC 17025:2005

TAPTITE PRO

Discover our newest and innovative Smart Factory Logistics System

SmartBin Cloud & SmartLabel Cloud



LPS Bossard Pvt. Ltd. | Universal Precision Screws

NH-10, Delhi-Rohtak Road, Kharawar By Pass, Rohtak-124001 (INDIA)

Ph. : +91 - 1262-205205, 205262 Fax : +91 - 01262-205111, 205112

Email : india@lpsboi.com, customer@upsind.com | Website : www.bossard.com | www.upsind.com

CELEBRATING 75 YEARS

CK BIRLA GROUP

nbc flexible solutions



We look at bearings as wheels that keep your business on the move. We therefore provide solutions that help you increase the efficiency of your operations and boost your day-to-day productivity, for years.

Offering 2300+ Variants Across Industries: Automotive | Aerospace | Railways | Industrial Steel | Cement | Power | Construction Equipments | Mining | Motor | Pumps and many more..



20 mm ——————————— 2000 mm

To find a bearing solutions that suit your needs, call us on **1800 3000 6222** or write to us at **neisales@nbcbearings.in** | Visit: **www.nbcbearings.com**

Follow us on:
/nbcbearings

Driving in night was

NEVER SO SAFE

In India, almost 1.50 lakh people die in road accidents every year; more than 50% fatal accidents occur at night.

Through advancements in Auto Lighting Technology with LED's, we are lighting the road ahead, bringing safety to the fore-front.



NEOLITE

ADVANTAGE :

- One of the largest OEM suppliers in India.
- Customer-base of over 40 prestigious OEM's.
- Exporting to over 70 countries worldwide.
- State-of-the-art infrastructure with modern facilities.
- Experienced work-force and dedicated R&D team.



Neolite ZKW Lightings Pvt. Ltd.
Board Line: +91-1276-350001, E-mail: info@neolitezkw.com
Website: www.neolitezkw.com

NEOLITE
AUTOMOBILE LIGHTING

LOGISTICS FOR india

FINE-TUNE YOUR SUPPLY CHAIN WITH SAFEXPRESS

OVER 26 YEARS EXPERTISE IN AUTOMOTIVE LOGISTICS

OUR OFFERING FOR AUTOMOTIVE INDUSTRY

- Fastest multimodal connectivity through Surface and Air, especially for time-sensitive consignments such as spare parts for off-road vehicles
- Deepest reach to the remotest corners of all 31238 pincodes of India, deliver directly to all your dealers & service centres located across tier II & III cities and towns
- Safest network operational on 24x7, 365 days in a year including Sundays & Holidays
- Vendor Managed Inventory for OEM manufacturers with assembly line-ready deliveries
- The only logistics company with NIC integration for auto E-Waybill validity extension
- Just-in-time delivery, ensuring lean inventory
- SafeReturns service for unsold inventory of spares back to suppliers
- Appointment deliveries
- Seamless connectivity from first to last-mile
- GST input tax credit benefit with 100% E-Waybill compliance

*Data updated as on 1st August, 2023



Scan the QR code for more details

1800113113

info@safexpress.com

www.safexpress.com

SAFEXPRESS
THE COMPLETE LOGISTICS SOLUTIONS

Distribution Redefined

SONA COMSTAR

GEAR UP
TOWARDS THE FUTURE!

We are proud to have crossed the production milestone of

350,000,000

Bevel Gears

Feb 2023



5,000,000

Differential Assemblies

Jul 2023



Electrifying the
future of mobility!



Subros Limited, founded in 1985 as a public limited company with joint venture between the Suri Family of India, DENSO Corporation, Japan, and Suzuki Motor Corporation, Japan, is the leading manufacturer of thermal products for automotive & non-automotive applications, in technical collaboration with DENSO, Japan.

A Joint Venture between

DENSO | Subros | SUZUKI

marketing@subros.com

Subros Limited | www.subros.com

Cooling the Planet

SUNFLAG STEEL

BUILDING A RESILIENT INDIA WITH CLEAN STEEL

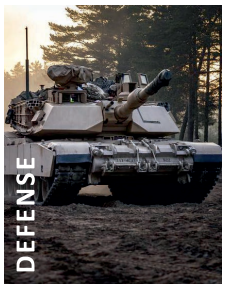


A mission and commitment to add qualitative value for enhanced customer satisfaction and nation building has been the guiding philosophy at Sunflag Group. This mission impelled the setting of one of the world's most advanced composite steel plant in India. Sunflag is a pioneer in manufacturing Alloy & Special Steels used for most critical components for automobiles, railways and defence. With a vision of "ATMANIRBHAR BHARAT" Sunflag has set up a state of the art Super Alloys manufacturing facility and started catering to Aero-Space, Nuclear, Power and Defence sectors.

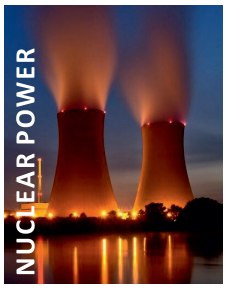
INDUSTRIES WE SERVE













FOLLOW US
sunflagsteel
sunflagsteel.com

Image India/SF/23

SUNFLAG Clean Steel®
State of the Art Process Technology

SUNFLAG IRON & STEEL CO. LTD.
Head Office : 33, Mount Road, Sadar, Nagpur - 440 001, +91 (0712) 2524661 / 2532901
Plant : Bhandara Rd., Warthi, Bhandara - 441 905, +91 (07184) 285551 - 285555
www.sunflagsteel.com

UNO MINDA
DRIVING THE NEW



LEADERS IN AUTO COMPONENT & SYSTEMS MANUFACTURING

DRIVING the NEW TECHNOLOGY

PERSONALIZED
Wireless Chargers, Logo Projectors, CAN-enabled Switch & Heat-cool Seat

AUTONOMOUS
Camera, Ultrasonic Sensors & ADAS

CONNECTED
Telematics Control Unit & IoT Platform

ELECTRIFIED
More than 12+ EV Specific 2W & 3W Products

Uno Minda Limited (Formerly known as Minda Industries Limited)
Corporate Office: Village Nawada Fatehpur, PO. Sikanderpur Badda, Manesar, Distt, Gurugram, Haryana-122004, India

www.unominda.com

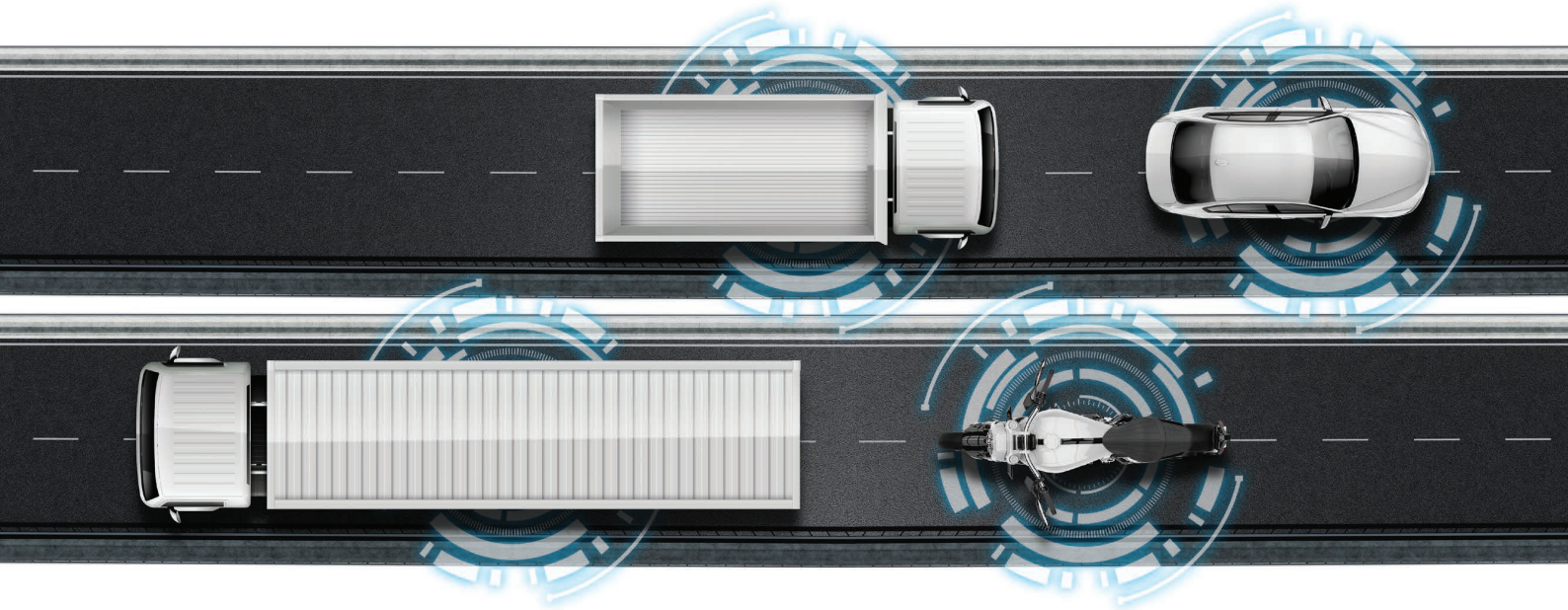
@unomindagroup | @unomindacom | @unominda | unomindagroup

Varroc
EXCELLENCE

INNOVATING
BEYOND BOUNDARIES.

Varroc is a trailblazer in the automotive industry, forging a future where innovation meets possibility. With Intelligent Lighting Solutions, Light-weighting Solutions, EV Solutions and Connectivity-enabled Solutions, we stand at the forefront of cutting-edge technology. Seamlessly integrating technology for enhanced performance, we unlock new horizons and lead the way to a brighter, limitless tomorrow.

8 Countries	**7000+** Employees	**36** Manufacturing Footprints
7 R&D Centers	**660+** R&D Engineers	**90+** Patents



PERFORM@CHANGE

Visit us on: www.varroc.com

ZUMEN

The Most Comprehensive **Direct Materials Purchasing & Supplier Collaboration Platform**

A perfect addition to your Enterprise ERP

We were recently recognized as a pioneer in the Direct Materials Purchasing & Supplier Collaboration space by ProcureTech & Kearney



Zumen is Offering

FREE

Subscription to its Supplier Collaboration Portal for ACMA members during this 63rd Annual Conference

Scan & Register Now

The Free-for-Life Portal allows you to:

- **Send Supplier Schedules**
- **Receive Supplier Commitments**
- **Generate Advance Shipment Notices**

SAVE SEVERAL LAKHS

Choose an industry Standard Software

www.zumen.com/supplier-portal/

ACMA

Automotive Component Manufacturers Association of India

63rd Annual Session - 'Mobility 360° - Sustainability For Cometitiveness'

September 13, 2022

Thank You Sponsors

Gold Sponsors

ALP THE ALP GROUP

DENSO Crafting the Core

Garrett ADVANCING MOTION

GNA ENTERPRISES

LUMAX DK JAIN GROUP

maxell Within the Future

SPARK MINDA Powered by Passion

SCHAEFFLER

SIGMA

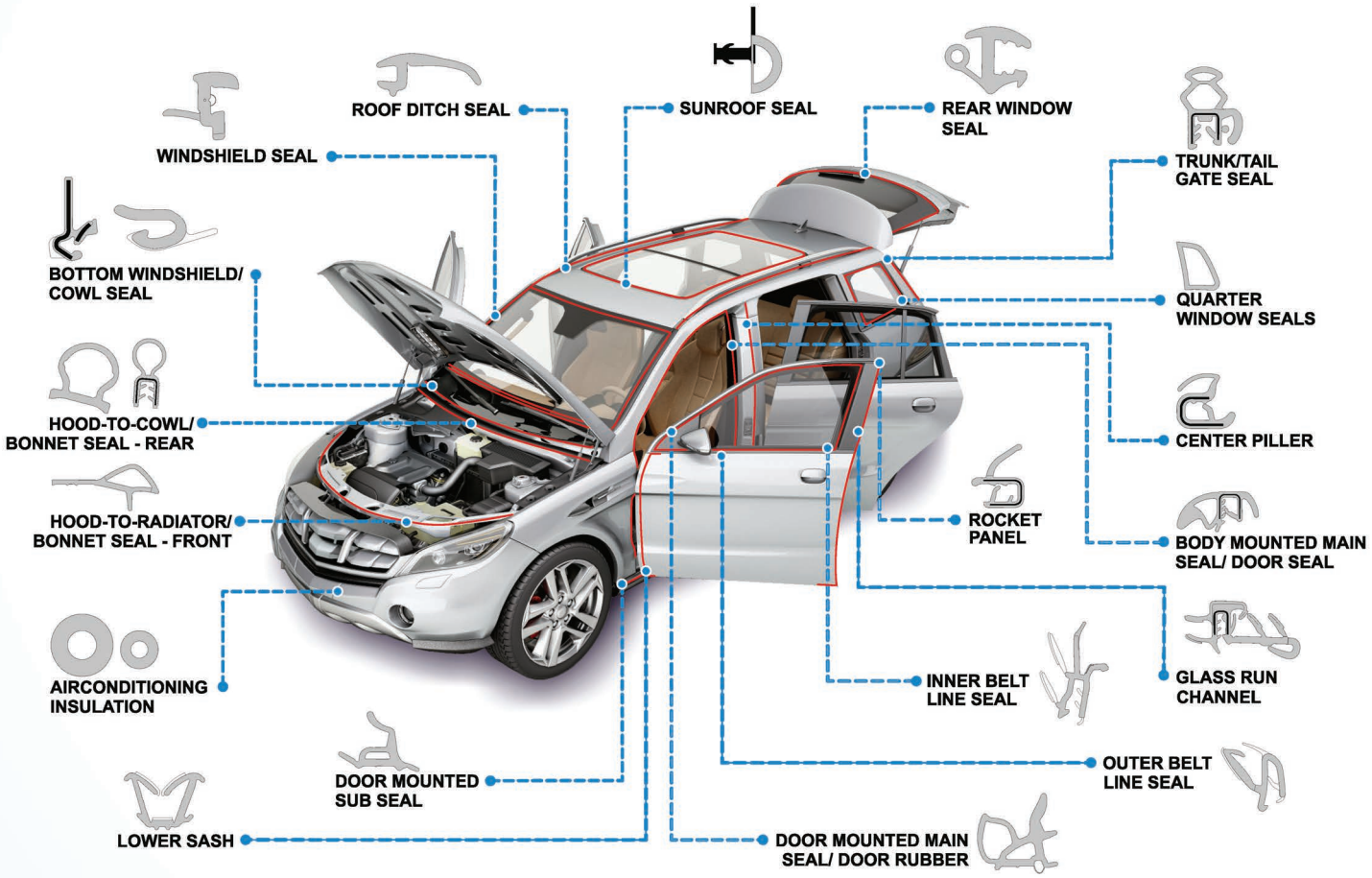
SUNSTAR INSPIRE PERFECTION

talbros

ALP
NISHIKAWA

expanding capabilities

EPDM/PVC/TPE/TPR/EXTRUDED PROFILES, MOULDED PARTS & WEATHER STRIPS



OUR VALUED CUSTOMERS

Profile & Seal for: Automotive & Building Industry, Shipping Containers, Railways, Bus Body & Air-conditioning etc

PRODUCTS: PVC & Sponge Sticking main seals, Dense Profiles for different applications, Door & Body mounted main seals & Sub-Seals, Flocked Glass Run Channels, Electric Panel Seals, Sponge Seals & Profiles, Wind Shield Rubbers, Shipping Container Seals, PVC Trims, Hood Seals, Trunk Seals etc., Nitrile Rubber Insulation (Hot & Cold) Tubes & Sheets for all Air conditioning Purpose.

ALP NISHIKAWA

Manufactured and Marketed by:
ALP NISHIKAWA CO. PVT. LTD.
Corporate Office: Plot No. 32, Sector-18 (HUDA), Gurgaon, Haryana-122015 (India)
Tel.: +91-124-4731600
website: www.alpnishikawa.com

Plant 1 : Plot No. 32, Sector-18 (Huda), Gurgaon - 122015
Plant 2 : 34Km, Chandigarh-Ambala Highway, Lalru-Punjab - 140501
Plant 3 : Plot No. E-7 & E-8, TML Vendor Park, Survey No. 1, Vill: Northcotepure, Taluka: Sanand, Dist: Ahmadabad, Gujarat-382110

Disclaimer: Although these values represent actual results achieved in tests, they should only be used as a guide. ALP Aeroflex cannot guarantee the performance of the product as all situations are different & should be treated separately. All statements & Technical informations are based on results obtained under typical conditions. It is the responsibility of the recipiant to verify with us that the informations are appropriate for specific use intended by the recipient.

Greater well-being for All

DENSO a global company focused on advanced mobility that positively changes how the world moves

QR Code® a two-dimensional code Invented by DENSO WAVE in 1994 and released license-free

World-First Products
Over 130
Patents Held
41,000

Global DENSO

Revenue
US$48 billion

Network
35
countries and regions
190
Consolidated Subsidiaries

Electrification, Powertrain, Thermal, Mobility Electronics and Advanced Devices (Semi conductor)

As a global Fortune 500 company, we have a broad product portfolio and widespread global impact

Bringing hope for the future for our planet, society and all people

Continuing to Create Value for the Mobility Society

DENSO in India

Since 1984 engaged in Manufacturing and Design application of Advanced automotive technology, systems and components for automobile, catering to almost all the major OEMs

7 Manufacturing Units, 2 R&D Centers & Over 6300 Associates

India Rising : DENSO in India Supporting young India's Dreams

- Contributes to creating a Cleaner, Safer, Environment-friendly ride by using DENSO's Technologies
- Making "Global product" with "Make in India" concept by Leveraging India's Strengths, Software Technology Originating from India



Mr. Yasuhiro Iida
CEO India region

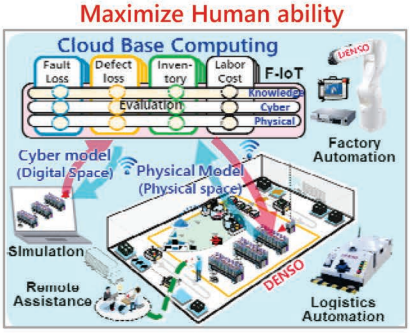
Manufacturing competitiveness ["Monozukuri"] Capability

High emphasis on Superior Quality & On-time Delivery Systems

- **Technological Transformation in production systems**
  - "Electrification Innovation" Factory thru : Digital Automation
  - "Carbon Neutrality" by 2035 : through Eco-friendly manufacturing
- **Crafting with Human Skill and Passion**
  - We pride on our young and diverse Talent for their 'Outstanding Creativity'
- **Driven by strong R&D especially to meet Indian customer needs**
  - Our Global R&D Centre works on Product Planning, Design & Development, System Evaluation & Calibration for Electrification, ADAS, Connected Technologies, Software Innovation & more

■ Denso Manufacturing ioT & Automation Platform

Maximize Human ability



DENSO Vision : "Mobility Well-being" Sensitive toward 3 issue

Pollution Free



Electrified Mobility

Accident Free



Automated Mobility

Stress Free



Connected Mobility

DENSO is making efforts for accomplishing the globally shared SDGs



DENSO INTERNATIONAL INDIA PVT. LTD.
Plot No.:3, Sec-3, IMT, Manesar
Gurgaon - 122050 (Haryana) – INDIA

DENSO
Crafting the Core

Garrett
ADVANCING MOTION

TRANSFORMATIVE TECHNOLOGY IS IN OUR NATURE

Turbo Technology | Electric & Hybrid | Connected Vehicle



Garrett Motion is a **differentiated technology leader,** serving customers worldwide for more than 65 years with **passenger vehicle, commercial vehicle, after market replacement, and performance enhancement solutions.** The company's cutting-edge technologies enable vehicles to become cleaner, more efficient and connected. With a comprehensive portfolio comprised of turbocharging, electric boosting, and software solutions, Garrett empowers the global automotive industry to redefine and further advance motion.

From industry-firsts like **fuel cell compressor** to its award-winning **E-turbo,** Garrett's highly specialized engineering teams have been expanding the brand's iconic turbocharging legacy to lead exciting breakthroughs for **advanced software, hybrid** and **electric powertrains.**

Scan to know more about Garrett's cutting-edge technologies and ccapabilities

www.gnaent.com

GNA ENTERPRISES



A Continuous Drive Towards Excellence

Guru Nanak Auto Enterprises Ltd., is a preferred supplier having IATF 16949, ISO14001, ISO 45001, FORD Q1 certifications and over seven decades of manufacturing excellence. With state-of-the-art manufacturing facilities and in-house R&D, the company manufactures a wide range of safety and critical forged & machined components for M & HCVs, LCVs, Off-highway Vehicles, Passenger Cars, SUVs and Tractors applications to all major OEMs & Tier1's globally with the support of its fully automated robotics equipped manufacturing lines, using modern integral Production & Quality Systems.

Product Range

Rear Axle Shafts	Companion Flanges	Input Shafts	Output Shafts	Intermediate Shafts
Torsion Bars	Output Flanges	Half Shafts	Drive Shafts	Clutch Shafts
Yoke Shafts	King Pins/Pivot Pins	Brake S'Cam Shafts	Track Bars	Wheel Spindles

GURU NANAK AUTO ENTERPRISES LIMITED

Corporate Office: Jamalpur, G.T. Road, Near Phagwara-144 632, Distt. Kapurthala (Punjab), India
Phone: +91-01824-504700, Fax: +91- 01824-504703, Email: gnae@gnaent.com

SINCE 1946

OUR ESTEEMED CUSTOMERS:

Ashok Leyland, DAIMLER, DANA, DANA SPICER, Ford, HINO, Indian Defence, JTEKT, MAN, MARUTI SUZUKI, SCANIA, SML ISUZU, TATA, TOYOTA, UD TRUCKS, EICHER

*All logos are regd. trade marks of the respective companies.



LUMAX

Global Standards
Indian Roots

Proudly **Making in India** since 1945

As a multi-product, multi location, multi partnerships group, we have proudly been **Making in India** for Global and Indian OEMs **since 1945.**

BUILDING TRUST SINCE 1945

DK JAIN GROUP

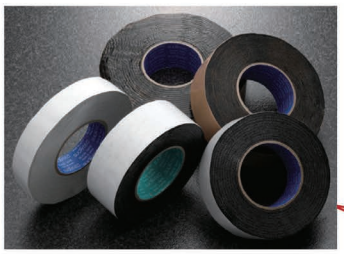
www.lumaxworld.in

maxell
Within, the Future

"Introducing 4 Solutions to the 63rd ACMA ANNUAL SESSION 2023"

Since its foundation in 1961, Maxell has been providing innovative products to the world using its proprietary technologies.
We have been providing a variety of inspiration for people's lives.
Maxell stands for "Maximum Capacity Dry Cell, and our founding philosophy of aiming for global market with product quality is becoming our DNA. Each of the product we display this time is a key component that is indispe nsable for a car.

Fixing and vibration absorption

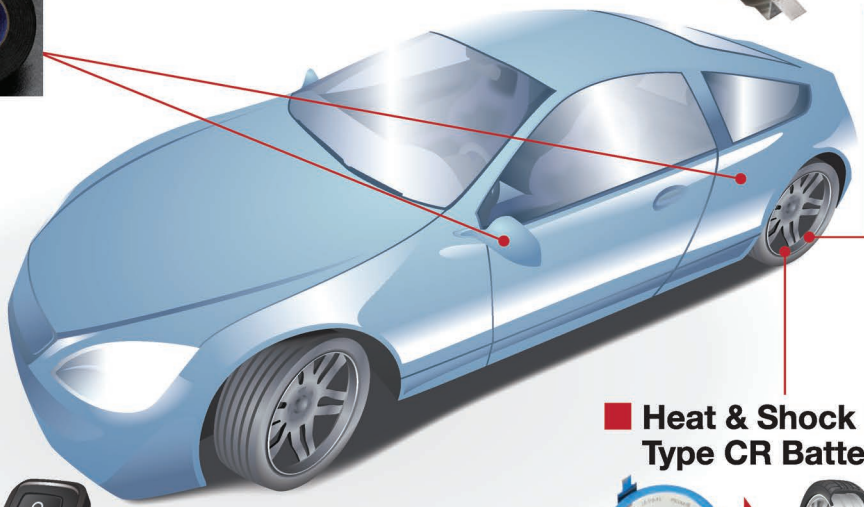


Heat Resistant Coin Type CR Battery





Rim mount type TPMS sensor
(Tire Pressure Monitoring System)



High Power Coin Type CR Battery





Smart Key

Heat & Shock Resistant Coin Type CR Battery





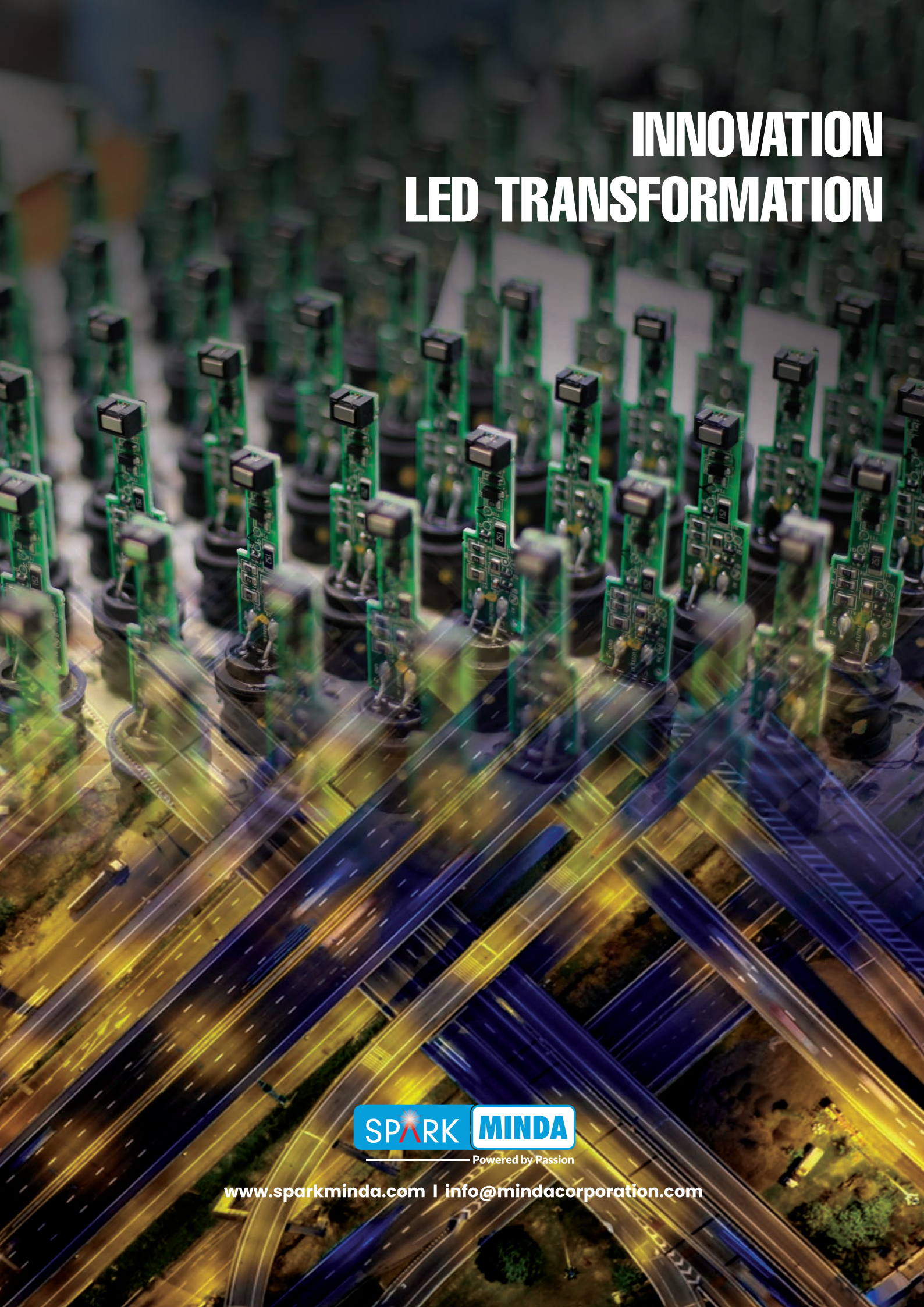
Tire mount type TPMS sensor



One of the exhibited product, the Heat-Resistant Coin Type Battery, is a battery used in the Tire Pressure Monitoring System (TPMS). Maxell commercialized this product in 2004 and now we have the world's top class market share* for TPMS usage.
*Maxell estimate as of October 2022.
Since August 2018, Maxell has been accepting foreign trainees from India, who are involved in the production of Heat-Resistant Coin Type Battery.
In India, we are committed to contributing to the well-being of society by continuing to develop and provide products that are safer and more reliable. We also look forward to the Indian market.

Contact

Maxell Asia, Ltd. (Chennai Office)
Address : C/O NICHE BUSINESS CENTRE. No:10, First Floor, Second Avenue, Harrington Road, Chetpet, Chennai-600031, India
Phone (+91) 44-2836-5152


INNOVATION
LED TRANSFORMATION
SPARK MINDA
Powered by Passion
www.sparkminda.com I info@mindacorporation.com



We pioneer motion

CO_2-efficient technologies for conventional and future mobility.

Schaeffler uses its pioneering and innovative spirit to underline its claim to be a technology partner that pioneers motion to advance how the world moves.

Our Automotive Technologies division is meeting the challenge of dynamic change in the drives sector by designing excellent and sustainable technological solutions for conventional and future mobility i.e., cars and commercial vehicles. Learn more about how Schaeffler can help you achieve your sustainability goals.

SCHAEFFLER




SUSPENSION


POWERTRAIN


BRAKING SYSTEMS


DRIVETRAIN


SAFETY


EV DRIVESHAFTS

SIGMA®

Leadership thru excellence

www.sigmacorporation.com

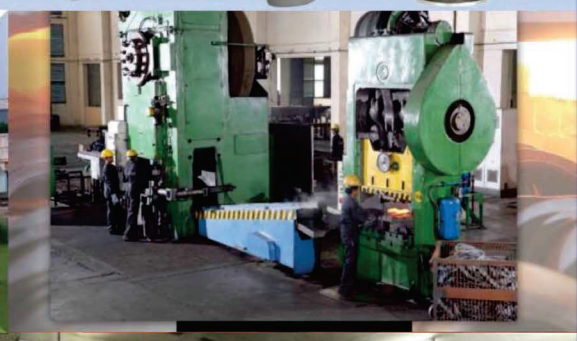
SUNSTAR

INSPIRE PERFECTION















Our Respective Costumers

Brakes India

Cummins

MERITOR.

SONA COMSTAR

Ege Fren

api group

TATA MOTORS

CARRARO

comer industries

JAGUAR

LAND ROVER

Mahindra

DAIMLER

LEAX GROUP 40 YEARS ANNIVERSARY

CNH INDUSTRIAL

VE COMMERCIAL VEHICLES
A VOLVO GROUP AND EICHER MOTORS JOINT VENTURE

Automotive Axles Ltd.

DANA

HONDA POWER PRODUCTS

JCB

TRELLEBORG

Product Range

Crown /Pinions Forging,
End Yoke, Yoke Shaft, Shifter Forks,
Companion Flange, Sleeve Yoke,
Gear Blanks, Operating Shafts
Steering Arms, Tie Rod Arms,

Sunstar Precision Forge Ltd.

Plot No. 12 Ecotech- III
Greater Noida, Uttar Pradesh 201306
Email :- sunstar@sunstarforge.com
Website :- www.sunstarforge.com
Phone :- +91-120-6747070

talbros

Driving Future Leadership

Move the Auto World



• Gaskets • Steering & Suspension Components • Forgings • Heat Shields
• Chassis Systems • Rubber Moulded Components • Rubber Hoses

www.talbros.com

ACMA

Automotive Component Manufacturers Association of India

63rd Annual Session - 'Mobility 360° - Sustainability For Cometitiveness'

September 13, 2022

Thank You Sponsors

Associate Sponsors

ARaymond

ASK — DRIVING SAFETY THROUGH INNOVATION

Brakes India

Continental — The Future in Motion

IP Rings — Amalgamations Group — Innovate Excel

JSW Steel

Lucas TVS — DRIVEN

NRB BEARINGS

PCP PARACOAT — SOUND IDEAS FOR SILENCE

pricol — PRICOL LIMITED — Passion to Excel

Rane — Expanding Horizons

ROCKMAN

RSB — Where Dreams are Responsibilities

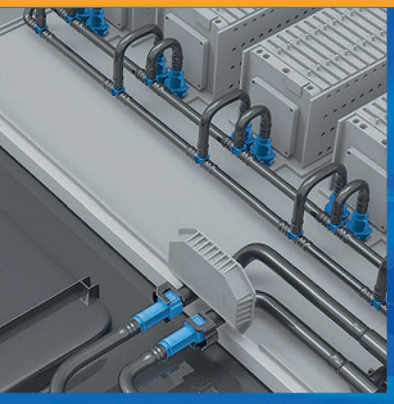
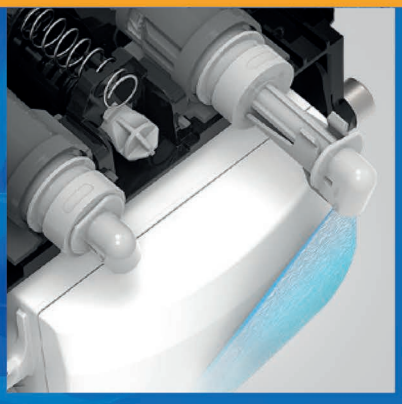
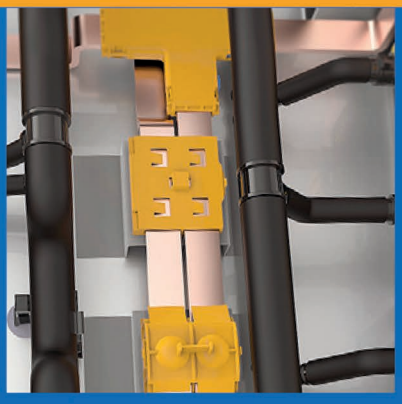
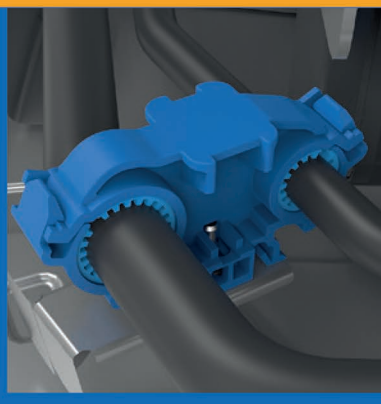
SHRIRAM PISTONS

WHEELS INDIA LIMITED

ARaymond

YOUR PARTNER FOR THE FUTURE OF MOBILITY

ASSEMBLY EFFICIENCY • SECURED FLUID HANDLING
HIGH PRECISION CAMERA AND SENSOR CLEANING

www.araymond-automotive.com

contact.in@araymond.com

DRIVING
SAFETY
THROUGH
INNOVATION

MANUFACTURER AND SUPPLIER OF SAFETY SYSTEMS AND CRITICAL ENGINEERING SOLUTIONS FOR MORE THAN THREE DECADES.



MANUFACTURER OF ADVANCED BRAKING SYSTEMS, ALUMINIUM LIGHTWEIGHTING PRECISION SOLUTIONS AND SAFETY CONTROL CABLES

- The largest manufacturer of **Brake-Shoe** and **Advanced Braking Systems** for **Two-Wheelers** in India with a market share of approximately **50% in Fiscal 2022***
- **Recognized as India's Leading Brand*** in the **2-Wheeler** Independent Aftermarket
- Operate **15 Manufacturing Facilities** across five states in India
- **Long-standing Relationships** with all top six **2-Wheelers OEM Customers in India** ranging from **15 years** to more than **20 years**

2-Wheeler | 3-Wheeler | 4-Wheeler | Commercial Vehicle

For any information or queries,
reach out to us at **info@askbrake.com**

www.askbrake.com

*In Terms of Production Volume for Fiscal 2022

Brakes India

ACCELERATE
CONFIDENTLY BRAKE
SECURELY



Scan the QR Code
to visit our website

PARTNERS FOR SAFE MOBILITY SINCE 1962

Continental
The Future in Motion



Safe.Connected.Convenient

We drive the future of mobility

We develop pioneering technologies and services for sustainable and connected mobility of people and their goods. Founded in 1871, the technology company offers safe, efficient, intelligent, and affordable solutions for vehicles, machines, traffic, and transportation.

www.continental-automotive.com

Can you feel
our heartbeat?

IP Rings Ltd.
(A member of the Amalgamations Group)



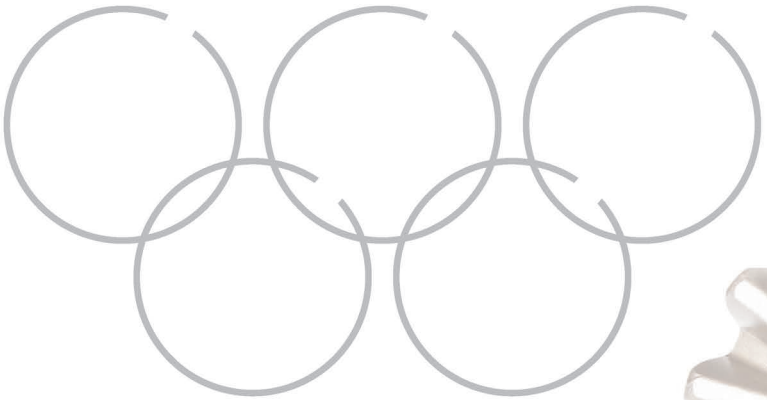
Contributing to a cleaner, greener planet

At IP Rings we deliver tomorrow's technology today to service the country's vision of a clean, green society.

Technology with a heart - Through Euro 6 ready components and processes, recyclable & bio-degradable non-hazardous materials and green factories.

Light-weighting technologies – engineering with a conscience through re-engineering of product and system solutions with reduction in material consumption and value engineered solutions.

Friction reduction technologies – Designed with a principle of latest specialty surface engineering concepts leading to smaller, thinner and lighter products and tribological engineering solutions to extend product life.





Thinner. Lighter. Stronger.

JSW Steel

JSW Automotive Steel

CERTIFIED

First **GreenPro certified** Indian steel for Automotive industry



GreenPro certified range of steel products

Hot Rolled | Cold Rolled | Wire Rods

GreenPro is an ecolabel certification, developed by the CII recognizing the highest standards of environmental sustainability and product performance in the Indian manufacturing sector.

www.jswsteel.in
Toll-free No : 1800-225-225

JSW Steel


What do you call a company with boundless energy to excel?
Driven.
At Lucas TVS, we are driven by a passion for excellence. Everything that we do, from products and processes to services, is engineered to put YOU in charge.
We strive to augment our technology expertise and offer you unmatched reliability. To this end, we ceaselessly innovate.
Today, Lucas TVS has customers across the world and nurtures global ambitions. What keeps us going is just one thing. Energy.
Lucas TVS
DRIVEN
Starter Motors | Alternators | Wiping Systems | Motors | Ignition Systems | Filtration | E-Mobility Solutions | Aftermarket Auto Electricals
To know more visit www.lucas-tvs.com

NRB BEARINGS

Powering Vehicles across the Globe

Friction Solution
provider to customers
in 26 Countries
across 5 Continents



Over 3000 Different Products
catering to the mobility segment

NRB BEARINGS LIMITED
Dhannur, 15, Sir P. M. Road, Fort, Mumbai- 400001
Tel: 022-22664570 / 22664998 Fax: 022-22660412 / 22679850
www.nrbbearings.com E-mail: marketing@nrbbearings.co.in









PCP

PARACOAT

is dedicated to spearheading sustainable solutions for noise reduction & thermal management paving the way for a world that is quieter and safer.

Sound Ideas for Silence

pricol

Best in class solutions to
Redefine Future of Mobility

> Driver Information & Connected Vehicle Solutions



E-Cockpit



LCD Cluster



TFT Cluster



Hybrid Cluster



Heads Up Display (HUD)



Telematics



Fuel Level Sensors



Battery Management System

> Actuation, Control & Fluid Management Systems



Fuel Pump Module



Wiping Systems



Oil Pumps



Disc Brake System



Water Pumps



Electrical Coolant Pumps



Variable Displacement Oil Pumps



Electrical Oil Pumps



Electrical Purge Valve



Cabin Tilting System

OUR PARTNERS

SIBROS (End–to-End Solution with Cloud & Cyber Security Telematics)

BMS (Battery Management System)

PRICOL LIMITED
Passion to Excel

109, Race Course, Coimbatore - 641 018, India.
0422-4336000 connect@pricol.com


THE PARTS
THAT MAKE YOU,
DEFINE YOU.
Rane
Expanding Horizons
26 Manufacturing Locations • Serves 30+ Countries
Engine Valves • Valve Guides • Mechanical Steering & Suspension Systems • Power Steering Systems
Occupant Safety Systems • Steering Columns • Brake Linings • Disc Pads • High Pressure Die Casting Products
www.ranegroup.com

ROCKMAN

DRIVING INNOVATION & TECHNOLOGY

EMPOWERING ASPIRATIONS

Aluminium Die-Casting
2 & 4 Wheeler Alloy Wheels

Carbon Composites
Automotive Chains & Sprockets

- High Pressure, Low Pressure and Gravity Die Casting Capabilties
- Integrated Machining, Painting and Assembly lines
- Largest 2W Alloy Wheels manufacturer with more than 14 million annual capacity
- More than 240,000 tons of Aluminum processing capacity annually
- Customer First' approach to technology' ensuring excellence in engineering products
- 8 state of the art manufacturing facilities across India



corporate@rockman.in
+911143270701-04
www.rockman.in

www.rsbglobal.com

RSB
Where Dreams are Responsibilities

LEAD BY EXCELLENCE
COMMITTED TO QUALITY



OUR EXPERTISE
RSB ADVANTAGE

- Integrated Auto Components Manufacturer.
- 5 decades of expertise in the Automotive market.
- Top rated on the customer satisfaction index.
- Comprehensive product Design, Development, Testing, and Manufacturing capabilities.
- Fully Automated Robotic Line for welding.
- Latest Metallurgy & Metrology equipment.
- In-house Validation Lab for Quality control.
- Diverse products across vehicle segments.


Propeller Shafts


Gear Boxes


Fifth Wheel Coupling


Rear Axles


Front Axles


Suspension Systems


CMI Aggregates


CMI Attachments


Transmission Components


EV-Axles


EV-Reducers


EV-Motors

OUR LOCATIONS
MANUFACTURING UNITS

India	Pune, Jamshedpur, Cuttack, Pant Nagar, Lucknow, Dharwad, Chennai, Sricity
Overseas	US, Mexico

CORPORATE OFFICE

RSB Transmissions (I) Ltd., Office No.201/2/3/4, Pentagon 1, Second Floor, Magarpatta City, Hadapsar, Pune - 411013, Maharashtra, India
info@rsbglobal.com

CELEBRATING

50

YEARS OF

TOGETHERNESS

POWERING MOBILITY



Shriram Pistons & Rings (SPR) has an exceptional lineage of the Shriram group, one of India's oldest & most Reputed Industrial houses. SPR is today the **largest manufacturer** of Pistons, Pins, Piston Rings and Engine Valves in India and supplies to major OEMs in India and around the world, and the After Market. **The Company's partnerships with global leaders enables access to world-class technology and processes**, that have been implemented in its state-of-the-art manufacturing facilities at Ghaziabad (Uttar Pradesh) and Pathredi (Rajasthan). This includes a Tech Centre with **comprehensive in-house Design and Development facilities, recognised by Government of India.** SPR has provided several innovative cost effective solutions by partnering with OEMs in India and abroad that have won the Company recognition and rewards for Excellence in Manufacturing, Technology and Quality.

USHA®
PISTONS PINS RINGS
ENGINE VALVES

SHRIRAM PISTONS & RINGS LTD.

SPR®
AUTO COMPONENTS
& ASSEMBLIES

Technology Partners

KOLBENSCHMIDT GERMANY | HONDA FOUNDRY JAPAN | RIKEN CORPORATION JAPAN | FUJI OOZX JAPAN

WHEELS INDIA LIMITED

SCAN ME TO EMBARK ON
AN EXCITING JOURNEY!

WE MANUFACTURE

WHEELS

- Passenger Vehicles
- Light Cargo Vehicles
- Truck, Trailer & Bus Vehicles
- Defence Vehicles
- Mining Vehicles
- Agriculture & Farm Vehicles

VEHICLE CHASSIS & SUSPENSION

RENEWABLE ENERGY

HYDRAULIC CYLINDER

FABRICATED & PRECISION PRODUCTS



ACMA

Automotive Component Manufacturers Association of India

63rd Annual Session - 'Mobility 360° - Sustainability For Cometitiveness'

September 13, 2022

Thank You Sponsors

Green Corridor

BOSCH

Investment & Precision Castings Ltd

natesans

Synchronizing motion... with precision

SANDHAR

Growth. Motivation. Better Life

SELLOWRAP INDUSTRIES PVT. LTD. | SELLOWRAP EPP INDIA PVT. LTD.

SK GROUP COMPANY

TVS Sundaram-Clayton Limited

THE HI-TECH GROUP

ZF GROUP

ACMA

Automotive Component Manufacturers Association of India

63rd Annual Session - 'Mobility 360° - Sustainability For Cometitiveness'

September 13, 2022

Thank You Sponsors

Lunch Co-Hosts

Delphi – TVS Technologies

EMDET
IATF – 16949:2016 Certified Company
www.emdetjsr.com

Helical Springs
(Unit of T. K. Precision Private Limited)

KISWOK Since 1957
Engineering Better Tomorrows
65 YEARS OF EXCELLENCE

SABIND GROUP mil INTEGRITY & EXCELLENCE metalwork Industries Limited

NECLLP

New Swan

RICO

SANSERA ideas@work

EST. 1960
STUMPP SCHUELE & SOMAPPA SPRINGS

TATA
TATA AUTOCOMP

ACMA
Automotive Component Manufacturers Association of India

auto connect
BUILDING SUPPLIERS' NETWORK

सत्यमेव जयते
Ministry of Commerce & Industry
Government of India

8th Edition

Physical Meet

REVERSE BUYERS-SELLERS MEET

22ND - 23RD NOVEMBER, 2023

India International Convention and Exhibition Centre (IICC) Dwarka, New Delhi

An opportunity to meet global buyers from 40+ countries under one roof



PRODUCTS OF INTEREST

- OES Components
- Engine Components
- Electricals
- Rubber Components
- Drive Transmission and Steering
- Consumables & Misc.
- Cooling Systems
- Injection Systems
- Garage Equipment
- Tyre & Battery
- Lubricants, Accessories & Graphics

Heavy Duty & Tractor ♦ Commercial Vehicle ♦ 2 Wheeler

RETROSPECT
iAutoConnect OCTOBER 2022

"Over 130 Manufacturers, 800+ B2B Meetings, 130 International Buyers from over 30 countries."

Africa:	Kenya, Nigeria, South Africa, Algeria, Benin, Egypt, Ethiopia, Ghana, Uganda, etc.	LATAM & NAFTA:	Columbia, Mexico, Peru, Brazil, Argentina, Panama, USA etc.
ASEAN:	Indonesia, Thailand, Philippines, Vietnam, Myanmar, Malaysia, etc.	SAARC and Iran:	Bangladesh, Sri Lanka, Nepal, Iran, etc.
CIS:	Russia, Ukraine, Kazakhstan, Uzbekistan, kyrgyzstan, Azerbaijan etc.	West Asia:	Turkey, Jordan, Israel, Kuwait, Saudi Arabia, United Arab Emirates, etc.
Europe:	Italy, Denmark, Czech Republic, Poland, Greece, Hungary, Sweden, Germany, etc.	East Asia:	Japan, Korea

Scan for Registration

Scan for Exhibitors

Principal Sponsors

ANAND | JK Fenner | SONA COMSTAR | Subros | UNO MINDA THINK. INSPIRE. FLOURISH | varroc EXCELLENCE

Email : shardool.singh@acma.in • Mob. : +91-78384 38744

Web. : www.iautoconnect-acma.in

Ministry of Economy and Industry
Foreign Trade Administration

EMBASSY OF ISRAEL IN INDIA

ISRAEL

ISRAEL EXPORT INSTITUTE

ACMA

63 ANNUAL SESSION
13th September 2023

Israeli start-ups
@ the 63rd ACMA Annual Session - 13th September, 2023
at Shahjahan Hall, Taj Palace, New Delhi

To facilitate exposure to the Israeli Start-up ecosystem, ACMA with the support of Embassy of Israel is hosting Israeli Start-ups showcasing their technologies in the mobility space.

Objective :

- Explore strategic collaborations/ JVs/ Partnerships/
- Leverage innovations
- B-2-B meetings
- Perspective of the cutting edge research/innovation ecosystem in Israel

Start-up Company	Area of Technology
Make My Day https://www.makemydayapp.com/	The Smart Solution for EV Fleets to simplify EV fleet charging and operation with smart route planning for EV drivers and fleets.
MeyMaan Technologies https://maymaan.com/	Reinventing the Internal Combustion Engine · 70% water and 30% Ethanol · NO GASOLINE OR DIESEL REQUIRED!
M.E.A Testing http://www.meatesting.com	Dynamometers for Motor Testing
Gal Mobile https://galmobile.co.il/	Mobile Water Purification and treatment system

MAKE MY DAY | MayMaan AQUASTROKE | MEA Beyond Compare, Leading the Future | GALMOBILE™ Water Purification Vehicle

ACMA

EXPLORE GLOBAL BUSINESS POTENTIAL WITH US

CALENDAR OF ACTIVITIES 2024-25

FERIA DE LAS 2 RUEDAS
2nd - 5th MAY 2024 MEDELLIN

WEST AFRICA AUTOMOTIVE SHOW
14th - 16th MAY 2024, NIGERIA

AUTOMECHANIKA ISTANBUL
23rd - 26th MAY 2024, TURKEY

AUTOMECHANIKA HO CHI MINH CITY
20th - 22nd JUNE 2024, VIETNAM

LATIN AUTO PARTS, PANAMA CITY
31st JULY - 2nd AUGUST 2024, PANAMA

MIMS MOSCOW
19 - 22 AUGUST 2024, RUSSIA

AUTOMECHANIKA FRANKFURT
10 - 14 SEPTEMBER 2024, GERMANY

IAA TRANSPORTATION, HANNOVER
17 - 22 SEPTEMBER 2024, GERMANY

AUTOMECHANIKA DUBAI
2 - 4 OCTOBER 2024, DUBAI

INDIA NEPAL BSM
1st NOVEMBER 2024, NEPAL

AAPEX SHOW LAS VEGAS
5th - 7th NOVEMBER 2024, USA

Promoting Indian Auto Component Industry's Global Footprint

EQUIP AUTO ALGERIA
TBD

TECH EXPO USA
TBD

IAUTOCONNECT
TBD

EV EXPO
TBD





ACMA
Automotive Component Manufacturers Association of India
6th Floor, The Capital Court, Olof Palme Marg, Munirka, New Delhi - 110 067, India
Phone : 91-11-2616 0315 • Fax: 91-11-2616 0317
e-mail : acma@acma.in • www.acma.in