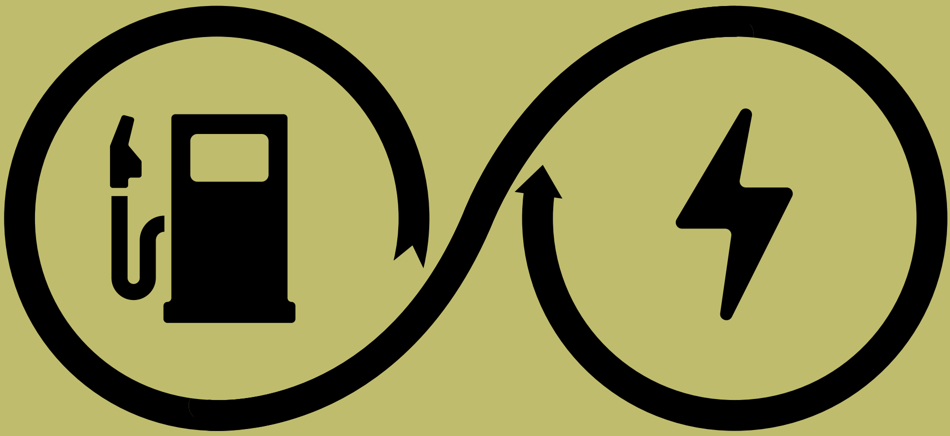

ICE to EV

CHALLENGES, OPPORTUNITIES, AND THE ROADMAP FOR JUST TRANSITION IN INDIA'S AUTOMOBILE SECTOR

iFOREST
INTERNATIONAL FORUM FOR ENVIRONMENT, SUSTAINABILITY & TECHNOLOGY

ICE to EV

Challenges, Opportunities, and the Roadmap for Just Transition in India's Automobile Sector

iFOREST
INTERNATIONAL FORUM FOR ENVIRONMENT, SUSTAINABILITY & TECHNOLOGY

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List of Abbreviations

2W	Two-wheeler
3W	Three-wheeler
AAT	Advanced Automotive Technology
ACC	Advanced Chemistry Cell
ACM	Auto Component Manufacturers
ACMA	Automotive Component Manufacturers Association of India
AMP	Automotive Mission Plan
AMU	Aligarh Muslim University
APS	Aspirational Policy Scenario
ARAI	Automotive Research Association of India
BCD	Basic Customs Duty
CAGR	Compound Annual Growth Rate
CPS	Current Policy Scenario
CV	Commercial Vehicle
DGT	Directorate General of Training
DIC	District Industries Centre
DSV	Determined Sales Value
EV	Electric Vehicle
FAME	Faster Adoption and Manufacturing of Hybrid and Electric Vehicles
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GoI	Government of India
GST	Goods and Services Tax
HIA	Hosur Industries Association
HOSMIA	Hosur Micro Industrial Association
HOSTIA	Hosur Small and Tiny Industries Association
ICE	Internal Combustion Engine
IIT	Indian Institute of Technology
ITI	Industrial Training Institute
MaaS	Mobility as a Service
MHI	Ministry of Heavy Industries
MIWA	Manesar Industrial Welfare Association
MoF	Ministry of Finance
MoHUA	Ministry of Housing and Urban Affairs
MoP	Ministry of Power
MoRTH	Ministry of Road Transport and Highways of India
MSDE	Ministry of Skill Development and Entrepreneurship
MSME	Micro, Small and Medium Enterprises
MSRTC	Maharashtra State Road Transport Corporation
NAPS	National Apprenticeship Promotion Scheme
NEMMP	National Electric Mobility Mission Plan
NFTDC	Non-Ferrous Material Technology Development Centre
NIC	National Industrial Classification
NIT	National Institute of Technology
NOC	No Objection Certificates
NSDC	National Skill Development Corporation
NSQF	National Skills Qualification Framework
OEM	Original Equipment Manufacturers
PLI	Production Linked Incentive
PMKVY	Pradhan Mantri Kaushal Vikas Yojana
PMP	Phased Manufacturing Programme
PSC	Parliamentary Standing Committee
R&D	Research and Development
RE	Renewable Energy
SIDCO	Tamil Nadu Small Industries Development Corporation Limited
SIPCOT	State Industries Promotion Corporation of Tamil Nadu
TCO	Total Cost of Ownership

Introduction

The automotive industry is undergoing three simultaneous transformations. First, regulatory change aimed at reducing air pollution, improving public health and fulfilling climate targets is pushing the industry toward electric vehicles (EVs) with the potentially imminent disappearance of the internal combustion engine (ICE). Second, a 'mobility revolution', made possible by digitisation and vehicle electrification, has the potential to overhaul vehicle usage and ownership models and disrupt the industry's traditional business models. Third, 'automation' across the automotive value chain is likely to have a considerable impact on workers and working environments. Intelligent production and servicing systems will require workers with different skills and will greatly impact the informal economy in the automotive industry. This, in turn, will have major impacts on jobs.

Overall, the paradigm change in mobility and transport will have a disruptive effect on the industry, workers and the local economy where these businesses are operating. But these disruptions can be minimised by adopting policies and practices that enables a just transition of the automobile sector.

The International Forum for Environment, Sustainability and Technology (iFOREST) has conducted a year-long research to understand what a just transition means and what it entails for the automobile sector in India. The research covers the following issues:

1. Growth projections of vehicles and EVs;
2. Impact of the transition from ICE vehicle to EV at the parts and component level;
3. Impact of the transition on auto components manufacturers;
4. Impact on the auto clusters; and,
5. Impact on workforce.

Based on the above-mentioned research, a roadmap to enable a sustainable, just, and inclusive future for India's automobile sector has been developed.

Summary for Stakeholders

India's automobile sector is poised for significant expansion in the near future, driven by the electric vehicle (EV) revolution. This shift promises to usher in a wave of new opportunities and growth avenues. However, it could also pose challenges for businesses, the workforce, and the environment. To mitigate these potential downsides, a sustainable and just transition of the automobile sector is essential. This approach should be underpinned by technological advancements and innovation, with a focus on safeguarding workers' well-being and job security. Moreover, it is crucial to encourage sustainable mobility choices that are affordable and accessible and reduce the environmental footprint of EVs throughout their lifecycle.

A. Growth Trajectory

A modeling study was undertaken to forecast the growth of electric two-wheelers (2Ws), three-wheelers (3Ws), passenger cars, and commercial vehicles (CVs), under two scenarios, viz., a Current Policy Scenario (CPS), and an Aspirational Policy Scenario (APS). The projections are made for two timeframes-2030-31 and 2036-37.

1. The EV penetration in India can reach 29-38% in 2030-31 and 47-67% in 2036-37, under different policy scenarios.

Vehicle manufacturing in India is projected to rise from 25.9 million units in 2022-23 to 54.5 million units by 2030-31, and further to 77 million units by 2036-37. Consequently, India's total vehicle production is expected to double by 2030-31 and triple by 2036-37 in comparison to present levels.

EV production is poised for an even more rapid acceleration. With an anticipated annual growth rate of 38-42% from 2022 to 2030 and 15-16% from 2030 to 2036, EV production is expected to range between 15.9 to 20.8 million units by 2030-31, scaling up to 36 to 51.4 million units by 2036-37. This remarkable increase will elevate EV penetration to between 29-38% by 2030-31 and 47-67% by 2036-37.

2. EV penetration will be highest in three-wheeler and two-wheeler segments.

EVs will dominate the three-wheeler (3W) segment, with their market share projected to increase to 90% by 2030-31 and approach nearly 100% by 2036-37. For the two-wheeler (2W) segment, adoption rates are forecasted to range from 30-40% by 2030-31 and between 50-70% by 2036-37. On the other hand, the penetration of EVs in the passenger car segment is predicted to be more gradual. Starting from a base of 1.2% in 2022-23, the share of EVs in this segment is expected to rise to 15-20% by 2030-31, and further to 25-50% by 2036-37, depending on various scenarios.

3. The EV market will be dominated by two-wheelers.

By 2030-31, more than 80% of all EVs produced in India will be 2Ws. On the other hand, the proportion of passenger cars within the total EV production is expected to rise from 7.7% in 2030-31 to 10% by 2036-37.

B. Impact on Businesses

The transformation from internal combustion engine (ICE) vehicles to EVs will have impacts across the value chain – from the original equipment manufacturers (OEMs) and auto component manufacturers (ACMs) to the service sector. This disruption will drive significant changes in the business models. The impact assessments on businesses rely on primary surveys of enterprises in major auto clusters, alongside assessments of government and industry data.

1. Depending on vehicle type, 45-84% of parts of an ICE vehicle will become obsolete due to EV transition.

The fundamental difference between an ICE vehicle and an EV is in the powertrain – a group of components that generate power and deliver it to the wheels. About 90-100% of parts of the powertrain of an ICE vehicle will become obsolete due to the transition to EVs, depending on the vehicle type.

The non-powertrain parts of ICE vehicles will also be moderately impacted. The obsolescence of parts in an ICE 2W will be 28%, 3W will be 37%, and in cars will be 12%. Besides, there are many similarities in non-powertrain components, and thus, these components of an ICE vehicle can be repurposed for an EV.

Overall, 45-84% of parts of an ICE vehicle will become obsolete. The obsolescence in the case of an ICE 3W will be as high as 84%, whereas it will be 45% in the case of passenger cars.

2. The powertrain supplier industry will be transformed by the shift to EVs.

Depending on vehicle type, the powertrain of EVs has 85-90% fewer parts compared to their ICE counterparts. Thus, there will be a significant impact on the business of ACMs as they will have to supply fewer parts. There will also be impacts on the spare parts and aftermarket activities resulting from the diminished number of wearable parts in the EV powertrain compared to an ICE powertrain.

3. Reducing the cost of batteries is key to reducing the total cost of ownership (TCO) of EVs.

The powertrain cost for an electric 3W is now lower than that of its ICE counterpart. This is the reason for the increased market share of electric 3Ws in India. On the other hand, for passenger cars, the powertrain of an EV is roughly 20% more expensive, primarily due to the higher cost of batteries. If the cost of the battery is set aside, the powertrain of an EV car costs less than half compared to that of an ICE car. Therefore, the reduction in battery and electronics costs is crucial for decreasing the TCO of electric cars.

4. One-third of the ACMs will be highly impacted by the transition with concentrated impacts on certain states.

An analysis of 729 members of the Automotive Component Manufacturers Association of India (ACMA) shows that about 34% of them will be highly impacted by the transition. Around 60% of these highly impacted ACMs are concentrated in the states of Haryana, Maharashtra, and Tamil Nadu. These enterprises primarily produce parts and components for powertrain sub-assemblies in ICE vehicles, including areas like 'engine-fuel-exhaust', 'transmission', and 'driveline'.

5. The transition impact on automobile clusters will be varied, and so will be the transition strategies.

A detailed study of three major automobile clusters in India—the Gurugram cluster in Haryana, the Pune cluster in Maharashtra, and the Hosur cluster in Tamil Nadu—indicates that the shift towards EVs will affect each cluster in unique ways. In the Gurugram cluster, for instance, over 40% of businesses will experience high to moderate impacts from the EV transition, with most of these being large and medium-sized enterprises. In contrast, in the Hosur and Pune clusters, about 20-25% of enterprises are expected to be affected, predominantly those that are small and micro in scale. As a result, the strategy for transitioning to EVs will need to be tailored for each cluster, considering their specific profiles and the scale of businesses within them.

6. ACMs have started transitioning to EV-related components, but mostly in the same segment.

From the primary survey of about 100 enterprises in each cluster, it was observed that 27% of enterprises in Gurugram, 21% in Hosur, and 45% in Pune are currently supplying EV parts to OEMs. However, most enterprises are making logical transition. They are expanding their business by supplying parts of the same sub-assembly for EVs. Only a small percentage were found to be transitioning/diversifying their business portfolio for manufacturing EV parts based on new opportunities in the EV ecosystem. This means that the ACMs involved in the ICE powertrain are not diversifying into EVs.

C. Impact on workforce

The shift from ICE vehicles to EVs will have implications for a large proportion of the workforce currently engaged in the manufacturing of ICE vehicles, as well as those engaged in the value chain such as servicing and repairs. The digital transformation in the automobile industry will also require a new set of skills from manufacturing to servicing. Therefore, a key consideration for the EV transition will be to ensure a planned transition of the existing workforce engaged in the ICE vehicle ecosystem to the EV ecosystem. Simultaneously, there will be a need for the development of a new workforce.

The impact assessment on the workforce was done based on primary surveys of about 300 ACMs and a total of 1,184 workers in the three auto clusters. Further, a comprehensive analysis of all job roles in the automobile ecosystem was done considering various secondary data sources, including the National Qualification Register and National Classification of Occupations (NCO) codes.

1. Job roles in the automobile sector are dominated by manufacturing and servicing.

The analysis of job roles shows that there are at least 564 job roles in the entire automobile sector. About 54% of them are related to manufacturing, followed by servicing and repairing accounting for an additional 16%. Research and development (R&D) and dealerships are the two other key segments accounting for 13.3% and 10.5% respectively. Overall, 70% of all the job roles are in manufacturing and service/repair.

2. Most job roles are at the NSQF levels 4 and 5.

Around two-thirds of the auto sector job roles fall between the National Skills Qualification Framework (NSQF) levels 4 and 5. These two levels generally represent jobs such as operators/technicians and managers. People working at NSQF 4 and 5 are skilled and have at least a higher secondary level education, but most are graduates, including those with technical degrees from polytechnics and Industrial Training Institutes (ITIs).

3. Contractual workers dominate the ACM segment.

The assessment of enterprises and workers in the three auto clusters shows that the largest share of workers in the ACMs are contractual workers. Besides, there is a significant proportion of informal workers. Overall, contractual and informal workers constitute nearly two-thirds (66%) of the workers in ACMs. The informality is higher in micro and small enterprises.

4. The impact of the EV transition will be significant on the workforce affecting 31% of the job roles in the ICE ecosystem.

About 31% of the job roles in the ICE ecosystem will be affected – 14% will become obsolete and 17% will require reskilling. Maximum job roles will be affected in ICE vehicle manufacturing. Out of the total job roles in this segment, 21.4% would become obsolete. This includes jobs like fuel injection technicians, clutch system specialists, and exhaust system inspectors, among others. Further 12.3% of jobs in the segment will require major reskilling interventions, in sub-assemblies such as transmission and driveline, among others.

5. The overall impact of the transition on the number of job roles will be positive.

Sixty-six job roles (14% of the job roles related to ICE vehicles) will become obsolete due to the shift to EVs. On the other hand, 92 new job roles (18% of the EV job roles) will be created due to EVs. Overall, the number of job roles in the EV ecosystem is about 5% higher than in the ICE vehicle ecosystem. However, the new job roles are qualitatively different than the existing job roles, as they require high skills and education levels.

Even for job roles that will not become obsolete, new skill sets will be required to retain workers in those roles. Therefore, skilling and reskilling of the workforce will be one of the most important interventions for the EV transition.

6. The job factor in EV cars is lower than ICE cars.

A detailed assessment of the number of jobs per passenger car (job factor) shows that at the OEM level, the job factor in an ICE car is about 20% higher than in an EV car.

At the ACM level, the job factor in the powertrain of an ICE car is about 10% higher than that in the powertrain of an EV. The job factor in the powertrain of EVs is likely to reduce further due to the economy of scale and automation. At the ACM level, the job factor in the non-powertrain of an ICE and an EV car is the same. However, the job factor in the non-powertrain of EVs is projected to reduce due to economy of scale and automation.

Overall, the number of jobs in manufacturing an ICE car is about 10% higher than in an EV car.

7. While the number of jobs supported by EVs are slightly lower than ICE vehicles, there will be a net increase in jobs in the automobile sector due to penetration of EVs.

The automobile sector is the third largest employer in the manufacturing sector accounting for 9.6% of employment. The transition to EVs will further boost employment in the sector due to new job roles and the demand of the workforce to produce more EVs.

iFOREST undertook a comprehensive modeling of jobs for the passenger car segment. The number of jobs was estimated for both the Current Policy Scenario (CPS) and Aspirational Policy Scenario (APS) till 2036-37. The CPS and APS scenarios were compared with a scenario in which it was assumed that only ICE cars were produced (ICE Scenario).

The results show that the total number of jobs in passenger car manufacturing is projected to grow from 1.7 million in 2023-24 to 2.6 million in 2030-31 and 3.3-3.7 million in 2036-37. So, there is no job loss per se due to the transition from ICE vehicles to EVs.

However, the number of jobs created in the CPS and APS scenarios is lower than those in the ICE scenario. In 2036-37, 8–17% fewer jobs would be created than in the ICE scenario. Thus, the number of jobs supported by EVs is relatively lesser than ICE.

D. Ensuring a Sustainable, Just, and Inclusive Future of the Automobile Sector

India needs to seize the opportunities of the momentous EV transformation, backed by technology and innovation, while ensuring workers' resilience and security, supporting sustainable choices by citizens that are affordable and accessible, and reducing the lifecycle impact of EVs to realise a sustainable and just transition of the automobile sector.

1. Just transition of the automobile section hinges on four key pillars that can aid the progress toward a sustainable, just, and inclusive automobile future.

The just transition vision of the automobile sector should be based on four pillars which are outcome-oriented and designed to guide the development of practical and holistic policies, plans, and investments.

Pillar 1-Technology and skilling: Will promote the simultaneous advancement of technology and the development of human resources to ensure the availability of skilled personnel to fully leverage technological capabilities and evolving demands. At the same time, technology needs to be designed and implemented in a manner so that job displacements are reduced and the prospects for new jobs and employability are enhanced.

Pillar 2- Vibrant green manufacturing: Will support the green growth agenda and is positioned to make India a hub of green automobile manufacturing.

Pillar 3- Sustainable mobility choices: Transition from automobile as a product to mobility as a Service (MaaS) will promote sustainable urban mobility, reduce congestion and pollution, and support a diversification of income opportunities around clean mobility.

Pillar 4- Green energy and material circularity: Will reduce the life cycle impact of EVs, from energy and material use, to end-of-life material management.

2. A comprehensive Just Transition Policy Framework for the Automobile Sector will be required to support a holistic transformation.

While there are policies, plans, and schemes developed by the Central and State Governments to increase the adoption of EVs, support infrastructure development, boost domestic manufacturing, and generate revenue and employment, however, to support a sustainable, just, and inclusive transition of the automobile sector, a more integrated policy framework is required.

The Government needs to develop a comprehensive Just Transition Policy Framework aligned with India's vision of strengthening opportunities for green growth and, boosting green jobs, fostering environmental stewardship, and building a clean mobility future.

3. A comprehensive e-Mobility Policy should be developed specifying targets.

The central Government needs to develop a national e-Mobility Policy to promote EV deployment while supporting an inclusive transition. The policy should define targets and plans for EVs that are long-term, consistent, and coherent across ministries.

4. Supporting R&D investments will be essential to make India an innovation hub.

R&D investments will be crucial for India to leverage its expertise in engineering and innovation to become a global leader in the development and adoption of cutting-edge automotive technologies. Also, standardisation of EV technology, especially for battery and charging parts and components, is important to drive down the costs of the vehicle as well as of the charging infrastructure. The Government should notify standards that align with the global best practices to drive down costs and enable EV adoption.

5. Green manufacturing in the auto sector will be crucial for achieving India's target of reducing the emission intensity of the GDP by 2030 and boosting green growth.

The Government needs to boost green manufacturing practices for both OEMs and ACMs by developing guidelines, providing fiscal and non-fiscal incentives, and technological support.

For example, incentives can be offered to the OEMs to adopt green manufacturing practices, such as utilising renewable energy (RE), investing in energy-efficient equipment, implementing green procurement measures, material reuse, etc.

For ACMs, providing fiscal incentives and technical assistance will be crucial given the predominance of MSMEs in this segment. The government can offer grants, subsidies, and tax incentives to MSMEs for adopting green manufacturing technologies and practices. It will also be important to ensure access of these enterprises to credit and risk capital to support investments in green manufacturing.

Overall, promoting industry benchmarking and reporting on environmental performance metrics, can help to champion best practices and improve industry performance.

6. A comprehensive workforce transition policy will be required to support the existing workforce impacted by the transition and prepare a future-ready workforce.

Transition of the existing workforce to the new EV ecosystem, and increasing employability of the future workforce lies at the core of ensuring a just transition of the automobile sector. The most important intervention in this regard will be reskilling and skilling the workforce to retain jobs and create a future-ready workforce.

To develop and invest in effective skilling programmes, coordination between the government, industry, skilling agencies, educational and training institutions, and other concerned entities will be necessary.

To facilitate a coordinated approach, a Skills Taskforce can be developed at the state level, consisting of members of OEMs, ACMs, skill councils, training institutes, and research institutions, to generate data on workforce profile, including their education and skills levels, to assess education and skill gaps to enable the design of training, academic and vocational programmes.

7. Mandating the development of a Workforce Transition Plan by OEMs will be required for strengthening enterprise-level action.

Mandating the development of a Workforce Transition Plan by the OEMs can be an effective policy instrument for workforce transition at the enterprise level, and complement government policies and transition measures. The plan for workforce transition should be output-oriented, outlining key performance indicators (KPIs) for monitoring its implementation.

8. A Right to Repair and Servicing Policy needs to be instituted to reduce the vulnerability of workers engaged in servicing and repairing.

Servicing and repairing jobs are a crucial part of the automobile ecosystem. This segment also includes a large number of informal workers. To reduce the vulnerability of workers in the servicing and repairing segment a 'Right to Repair and Servicing' policy can be effective. The policy should enable EV manufacturers to involve local service centers in repair and servicing and retain employment.

9. A dedicated transition fund is necessary to provide targeted support to the MSMEs.

The manufacturing segment of the automobile sector is dominated by MSMEs who have limited resources, technology, and the capability to adapt to the evolving needs of the EV sector, diversify their businesses, and provide reskilling support for workers. To support the MSMEs in a targeted manner, the Central Government may establish a dedicated transition fund for the MSMEs, including their workforce.

Towards this, the Government can issue necessary notification(s) and guidelines under the MSME Act, 2006. Aligned with the objective of the Act and the requirements of an EV transition, the fund can used for skilling and reskilling the workforce, providing grants, low-interest loans, or subsidies to enterprises for upgrading their manufacturing processes and adopting new technologies, and supporting the reorientation of enterprises and diversifying their customer base, among others.

10. Transition of the auto sector should be overall aligned with plans to diversify and strengthen regional industrial ecosystems and support demand for green jobs.

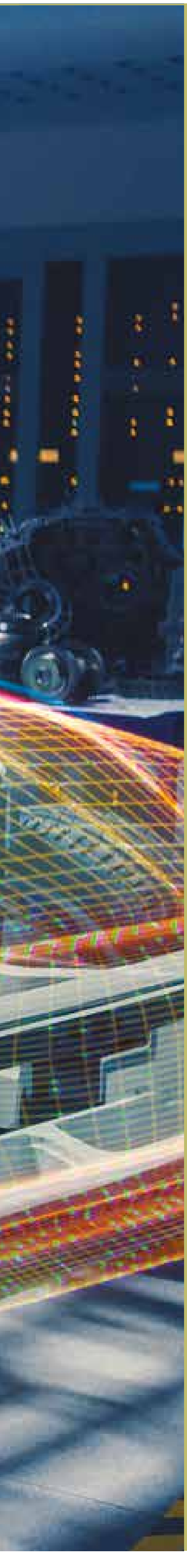
The transition from ICE to EV, should not be limited to a mere sectoral approach, it should be harnessed as an opportunity to support broad-based green economic growth and green jobs. The policies for the transition of the auto sector should be aligned with the industrial and economic policies of the state(s) and should aim to diversify and strengthen regional industrial ecosystems, support broader demands of green job creation, and maintain economic and social cohesion. For this, regional impact assessments of the ICE to EV transition can be undertaken to develop cohesive investment plans.

11. Supportive policies are required to shift the idea from vehicle ownership to Mobility as a Service (MaaS).

As the EV transition accelerates, it should be balanced by considerations of the sustainability of our urban spaces, and support a shift in the idea of mobility. The uptake of MaaS could bring about considerable environmental and societal benefits, such as lowering individual carbon footprint, reducing congestion, and boosting service sector employment opportunities in the clean mobility ecosystem.

12. Transition to EVs should consider a lifecycle approach, and should not be restricted as a tailpipe solution.

Achieving environmental sustainability in the EV transition requires a holistic approach that considers the entire lifecycle of EVs and addresses energy and material use at every stage. Using renewable-based energy will be important to minimise the carbon footprint of EVs. Similarly, sustainable mining practices for extracting raw materials for battery manufacturing, recycling of batteries, and research into alternative battery chemistries with fewer rare or toxic materials will be essential for reducing material extraction and use, and overall environmental impacts.



01

The EV Revolution : Growth Forecast

KEY FINDINGS

- Total vehicle production in India will increase from 25.9 million in 2022-23 to 54.5 million in 2030-31 and 77 million in 2036-37. The CAGR between 2022-2030 and 2030-36 is projected to be 9.7% and 5.9%, respectively.
- The production of EVs is projected to reach between 15.9-20.8 million in 2030-31, and 36-51.4 million in 2036-37. The EV penetration in 2030-31 is likely to range from 29-38% and 47-67% in 2036-37, based on different scenarios.
- Both in 2030-31 and 2036-37, 81% of all EVs produced in India will be 2Ws. However, the contribution of passenger cars to total EVs will increase from 7.7% in 2030-31 to 10% in 2036-37.
- The share of EVs in 2W segment will increase from 4% in 2022-23 to between 30-40% by 2030-31 and 50-70% by 2036-37.
- The share of EVs in 3W segment will increase from more than 50% in 2022-23 to 90% by 2030-31 and 100% by 2036-37.
- The penetration of EVs in the commercial vehicle segment is forecasted to be 25-33% in 2030-31 and 35-50% in 2036-37.
- The share of EVs in passenger car segment will increase from 1.2% in 2022-23 to 15-20% by 2030-31 and 25-50% by 2036-37, under different scenarios. The EV penetration in passenger car will be determined by TCO, consumer confidence and charging infrastructure.
- In all segments, the growth rate of EVs will be higher in 2022-30 period compared to 2030-36 timeframe, largely due to smaller base in 2022-23.

India is in the midst of an electric vehicle (EV) revolution. Driven by technological advancements, falling prices, government policies and incentives, and a growing consumer base, the country is poised to be a leading global player in the EV revolution.

But how fast can EVs grow in the country? If one goes by the pronouncements of the minister of road transport, then the Indian Government is rigorously pushing for an ambitious target of 30% EV penetration for passenger cars, 70% for commercial vehicles, and 80% for two- and three-wheelers by 2030.[1] The EV policies of various state governments indicate that most are trying for an EV penetration of around 15% by 2025 to 2027; some have even put the target of 30% by 2025 to 2027. But how realistic are these targets? How fast can EV be adopted in India?

iFOREST undertook a modelling study to forecast the production and sales of electric two-wheelers (2Ws), three-wheelers (3Ws), passenger cars, and commercial vehicles (CVs). The forecasting is done under two scenarios, viz., a current policy scenario (CPS) and an aspirational policy scenario (APS). The study makes projections for two timeframes — 2030 and 2036. The 2036 timeframe also marks 90 years of India's independence.

MODELLING SCENARIOS

1). For all vehicles, multiple scenarios were modelled, including linear extrapolation (excluding the COVID years), GDP elasticity, income elasticity and CAGR, to arrive at the best fit for each vehicle segment.

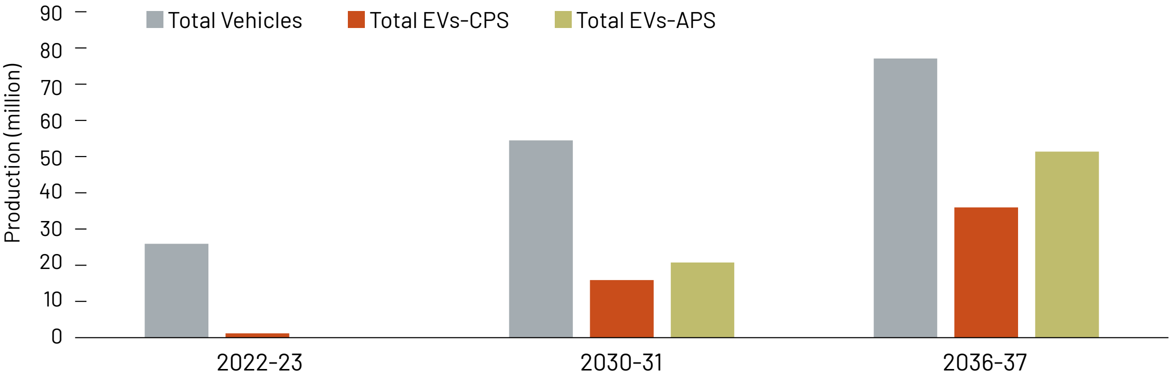
2). For EVs, two scenarios were modelled:

- **Current Policy Scenario (CPS):** The CPS is based on existing government policies and has been developed considering that the policies are implemented as per their intent (and not the informal targets). The implementation of FAME and the PLI scheme has been able to help achieve an indigenisation level of 90% in all segments of EVs. Simultaneously charging and battery swapping infrastructure are also created. The TCO of ICE vehicles and EVs will reach parity by 2025. Overall, during the projection period (2023-2036), the average GDP growth rate is 6.5%.
- **Aspirational Policy Scenario (APS):** The APS is based on more ambitious government policies to accelerate the EV transition. It assumes that FAME III is implemented for EV adoption which will further incentivise domestic manufacturing. Further policies are introduced and implemented to restrict the entry/movement of ICE vehicles in certain parts of the city to control air pollution. The TCO of EVs will be 10-25% less than ICE vehicles by 2030 for various segments. Overall, during the projection period (2023-2036), the GDP grows at a higher rate of 8%.

1.1 Total production

India produced about 25.9 million vehicles in 2022-23, of which the share of EVs was 4.8%. The total production of vehicles is projected to increase to 54.5 million in 2030-31 and 77 million in 2036-37. The Compound Annual Growth Rate (CAGR) between 2022-2030 is projected to be 9.7% and 5.9% between 2030-36.

Figure 1.1: Total vehicles production

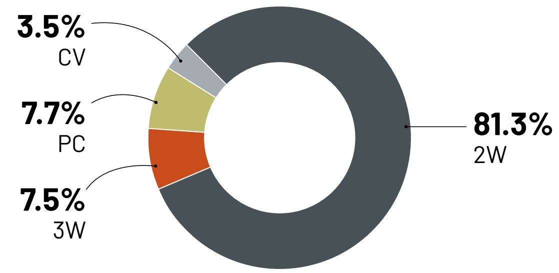


Source: iFOREST analysis

The production of EVs will increase at a much faster rate. The EVs production is projected to reach between 15.9-20.8 million in 2030-31, and 36-51.4 million in 2036-27. The growth rate of EVs between 2022-2030 is forecasted to be 38-42% and 15-16% between 2030-36. The EV penetration in 2030-31 is projected to be 29-38% in 2030-31 and 47-67% in 2036-37.

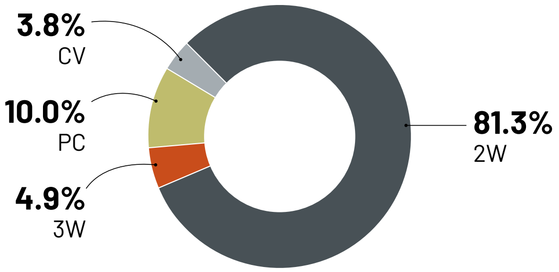
In 2030-31, 81.3% of all EVs produced in India will be 2Ws. The contribution of 2Ws will remain the same in 2036-37. The major change in composition of EVs will happen in the passenger car (henceforth car) segment. The contribution of cars to total EVs will increase from 7.7% in 2030-31 to 10% in 2036-37.

Figure 1.2: Composition of EVs - 2030-31



Source: iFOREST analysis

Figure 1.3: Composition of EVs - 2036-37



Source: iFOREST analysis

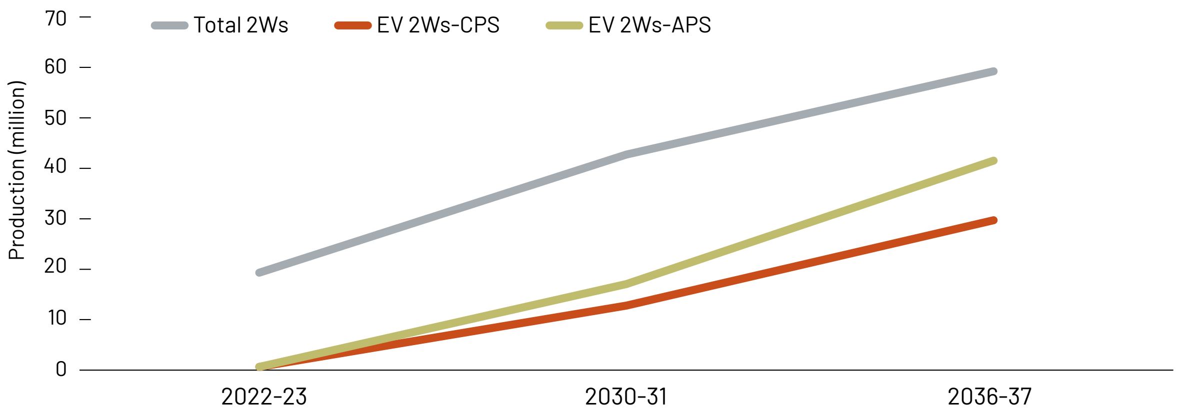
1.2 Two-wheelers

The production of 2W in India has experienced a strong growth rate in the last two years, except for the COVID years. An analysis of the pre-COVID years shows that between 2008-2018, the segment grew at a CAGR of 11%. During the COVID years, the production crashed from 24.5 million in 2018-19 to 17.8 million in 2021-22; the current production is still below the pre-COVID peak.

However, the total 2W production is projected to grow at 10.3% between 2022-30 and reach 42.7 million in 2030-31. The growth is likely to be much lower 5.6% between 2030-36. The production is projected to be 59.1 million in 2036-37, a whopping three-times the current level.

The share of EVs in the 2W segment is projected to increase exponentially in the next 15 years. In 2022-23, the production of electric 2W was about 4% of the total 2W production. This share is likely to reach between 30-40% by 2030-31. By 2036-37, the production of electric 2Ws will be 29.5-41.4 million, accounting for 50-70% of the total 2W production.

Figure 1.4: Projections for two-wheeler production



Source: iFOREST analysis

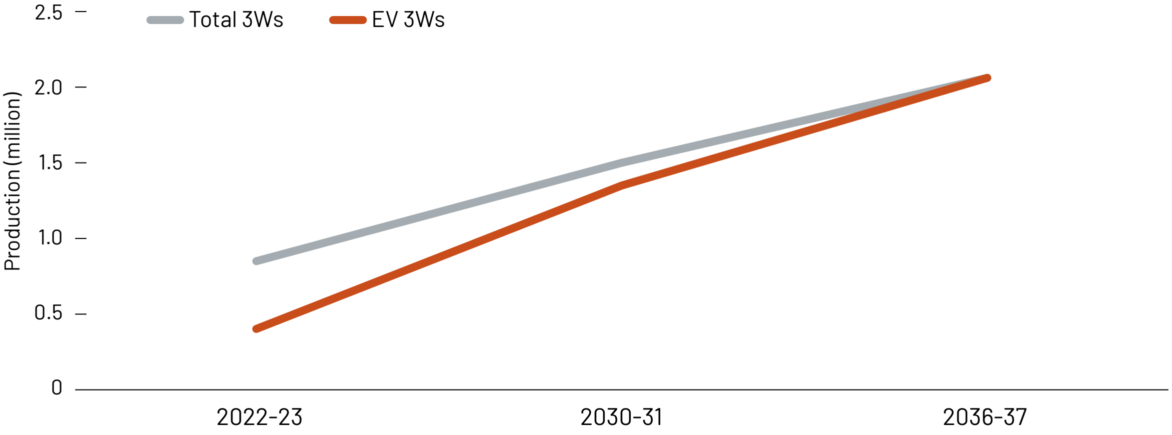
1.3 Three-wheelers

The production of 3W has also experienced a strong growth rate in the past years. An analysis of production data from the pre-COVID years shows that between 2008-2018, the segment experienced a CAGR of 9.7%. However, as in the case of 2Ws, the current production levels are still below the pre-COVID peak of 1.27 million in 2018-19.

The production of 3Ws is projected to grow at a CAGR of 7.3% during 2022-30 and at 5.4% during 2030-36. The total production is forecasted to be about 2.1 million in 2036-27.

The penetration of EVs in 3Ws is already more than 50% and is likely to reach 90 by 2030-31 and 100% by 2036-37.

Figure 1.5: Projections for three-wheeler production

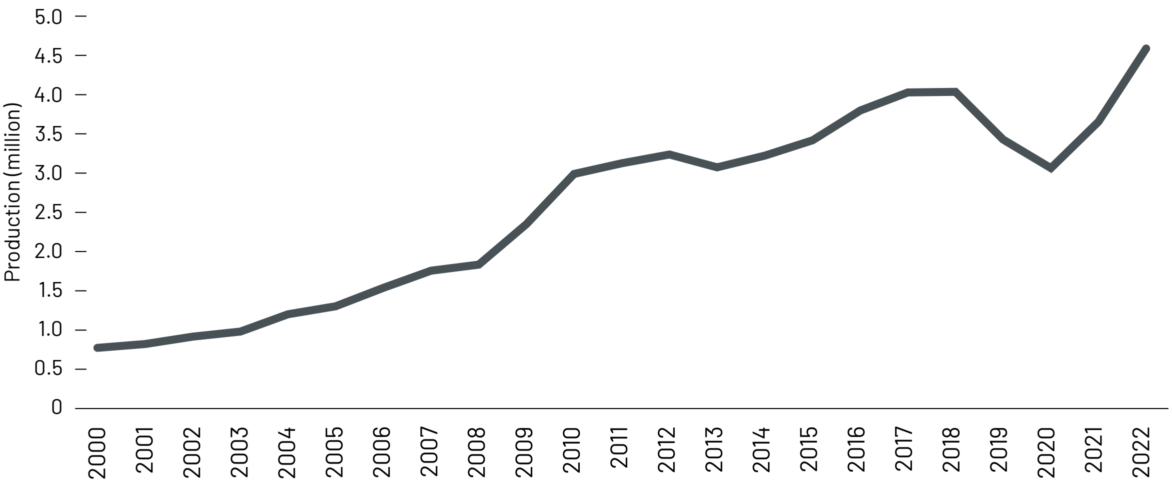


Source: iFOREST analysis

1.4 Passenger cars

The cars is the only segment that has recovered from COVID impacts, and the production in 2022-23 was at all-time high of 4.6 million.

Figure 1.6: Growth in Passenger Cars production

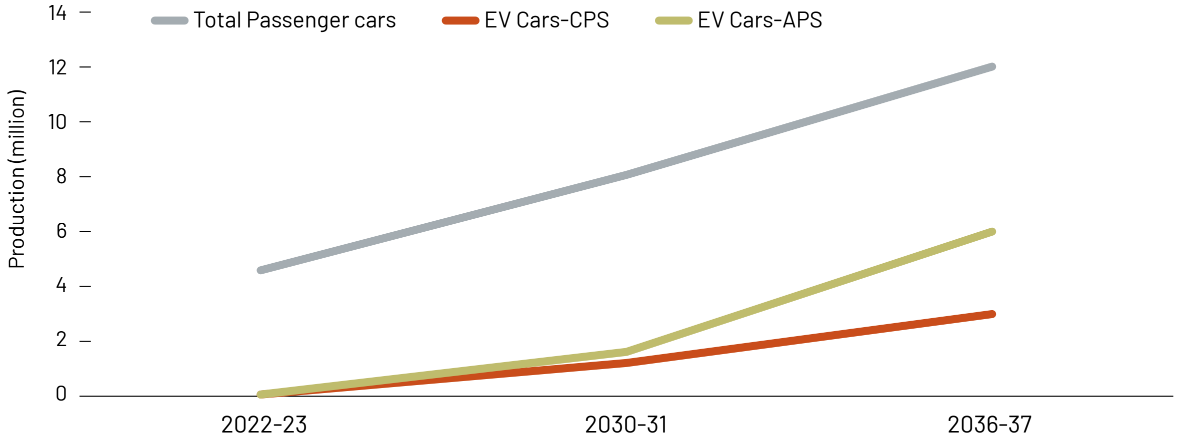


Source: iFOREST analysis

The production of cars is projected to grow at 7.3% between 2022-30 and reach 8.1 million in 203-31. The CAGR during 2030-36 is projected to be 6.9% and the total production in 2036-37 is likely to be 12 million.

Passenger car is the only segment where there is a large difference between the CPS and APS scenarios. This is largely due to differences in assumptions on TCO. Under CPS, the penetration of EVs in cars is projected to be 15% in 2030-31 and 25% in 2036-37. In APS, the EV penetration is much higher at 20% in 2030-31 and 50% in 2036-37.

Figure 1.7: Projections for passenger car production



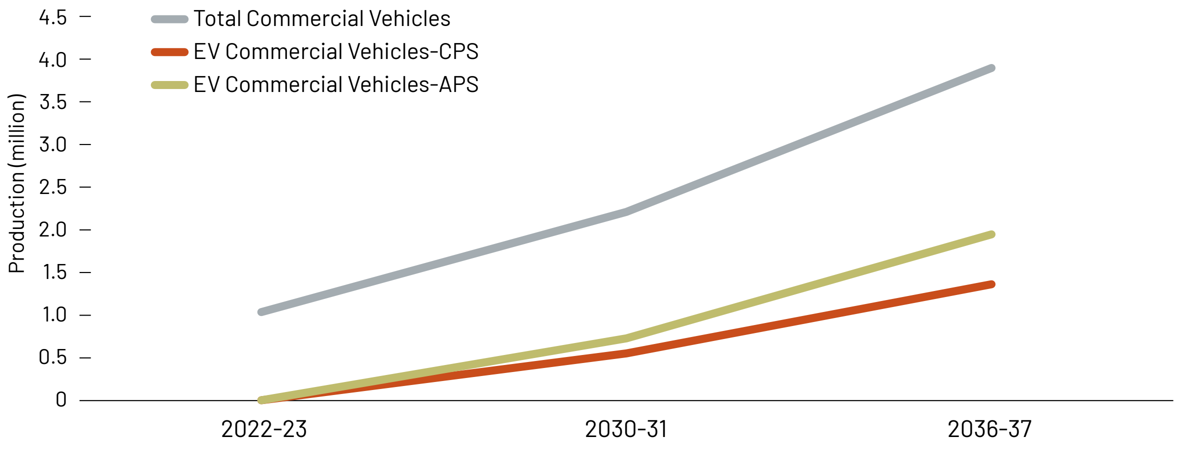
Source: iFOREST analysis

1.5 Commercial vehicles

The production of CVs has experienced the strongest growth after 2Ws in the past 15 years. Between 2008-2018, the segment experienced a CAGR of 10.3%. However, the production has still not recovered from the COVID impacts and the current production is about 10% lower than the pre-COVID levels.

The production of CVs is projected to remain robust from now till 2036-37 on the back of growth in GDP and consumption. The CAGR between 2022-2036 is projected to be 9.9%. The total production is forecasted to be 2.2 million in 203-31 and 3.9 million in 2036-37.

Figure 1.8: Projections for commercial vehicle production



Source: iFOREST analysis

The growth of EVs in the CV segment is likely to be very high. Between 2022-23 and 2031-32, the CAGR is projected to be 46-47%. The CAGR during 2030-36 is likely to be much lower at 16-18%. The penetration of EVs in the commercial vehicle segment is forecasted to be 25-33% in 2030-31 and 35-50% in 2036-37.

Overall, the growth projections shows that over the next 12 years, there will be a massive shift to EVs in various segments of automobile production. By 2036 with the implementation of ambitious policies to accelerate the EV transition, the production shares can reach up to 70% for 2Ws, 100% for 3Ws, and 50% for cars and commercial vehicles.

This means that various enterprises in the automobile sector will need to transition suitably to adopt to these fundamental changes in the technology. Simultaneously, there will also be a major impact on the workforce associated with the enterprises engaged in the production of ICE vehicle and auto components. The transition of this workforce, and development of new workforce to support the massive demand of skilled workers in the EV ecosystem will be a key issue.

02

Impact Assessment

The shift from ICE to EVs is the most momentous transformation of the automobile industry in the last 100 years. Primarily driven by the need to reduce air pollution and greenhouse gas (GHG) emissions, provide sustainable transport and enhance energy security, this transformation will have impacts across the value chain – from the original equipment manufacturers (OEMs) and auto component manufacturers (ACMs) to the workforce and the service sector. This disruption will drive significant changes in business models, research and development (R&D), and job markets.

To assess the impact of the transition from ICE to EV, the following four aspects were studied:

i. Impact on parts and components of 2Ws, 3Ws, and cars;

ii. Impact on ACM;

iii. Impact on auto clusters; and,

iv. Impact on workforce.

These four aspects are interrelated and have implications for designing policies, plans, and implementation measures for a just transition of the automobile sector.

2.1 Impact on parts and components

KEY FINDINGS

- Depending on vehicle type, 45-84% of parts of an ICE vehicle will become obsolete. The obsolescence for an ICE 3W will be as high as 84%, whereas it will be 45% in the case of cars.
- About 90-100% of parts of the powertrain of an ICE vehicle will become obsolete due to the transition to EVs depending on vehicle type.
- The non-powertrain parts of ICE vehicles will also be impacted moderately. Whereas about 12% of the non-powertrain parts of an ICE car will become obsolete, the obsolescence in ICE 2W and 3W will be as high as 28% and 37% respectively.
- The powertrain of EVs has 85-90% fewer parts compared to their ICE counterparts. This will can impact the business of ACMs as they will have to supply fewer moveable and wearable parts.
- The cost of the powertrain of an EV 3W is already cheaper than an ICE 3W; the reason for the higher penetration of EV 3Ws in the market. However, in the case of cars, the cost of the powertrain is about 20% higher due to higher battery cost. Excluding the battery, the cost of the powertrain of an EV car is less than half that of an ICE car. Thus, reducing the battery and electronics costs is key to reducing the TCO of EV cars.

The foundation for understanding the transition impact from ICE to EVs is to understand the impact on parts and components. Fundamentally, an EV is different from an ICE vehicle. In an EV, the engine is replaced by a battery coupled to an electric motor. The transmission of EVs is also a simple one- or two-speed integrated transmission compared to the highly-complex mechanical transmission required in ICE vehicles. The ultimate replacement of ICE with EV will lead to the disappearance of a large array of ICE-specific components. For instance, an EV does not need any of the components of a combustion engine, fuel tank, exhaust system, emissions control system, or air and oil filters. At the same time, it is significantly more complex from an electronic point of view and contains significantly higher semiconductor, electronics, and electrical content. However, this does not mean that everything will change. There are many similarities in non-powertrain components and hence the non-powertrain components of an ICE can be repurposed for an EV.

To evaluate the impact on parts and components, this study undertakes an impact assessment of the 2W, 3W, and car segment of the automotive sector. It does so by using a structured methodology guided by specific assumptions. Towards this purpose, an ICE and an EV 2W, 3W, and 4W of similar specifications from the same brand were studied in detail at the parts and component level. The make and brand of these vehicles are not disclosed to avoid revealing proprietary information.

The following approach has been followed for the evaluation:

- Identify and list all parts, sub-assembly-wise, in an ICE vehicle and an EV in 2W, 3W, and car segments.
- Collate the costs of each part (only for 3W and car)
- Categorise the parts into powertrain and non-powertrain for both ICE and EVs.

Based on the impact on the various parts under 20 sub-assemblies, the parts have been classified into the following impact categories:

- Impacted/obsolete parts;
- Non-impacted parts;
- Repurposed parts;
- New parts; and,
- General purpose parts.

Lastly, parts under various impact categories were added together to arrive at the final impact on the number of parts and their costs. The impact of general-purpose components was determined to be relatively small and hence has been ignored for analysis purposes.

DEFINITIONS

Powertrain: Powertrain assemblies refer to the combination of components that generate and transmit power to propel the vehicle.

Non-powertrain: Non-powertrain assemblies include components responsible for functions other than power generation or transmission. These are related to the vehicle's body, interior, suspension, braking systems, electronics, and other auxiliary systems essential for support, safety, comfort, and overall vehicle functionality.

General purpose: These comprise various fasteners, nuts, bolts, and other common components that are not directly associated with the powertrain or non-powertrain categories but are used for assembly and structural purposes both in ICE vehicles and EVs. The parts can be used in ICE vehicles and EVs and also by several other non-auto industries.

IMPACT CATEGORIES

Impacted/Obsolete: These are the components that will be directly affected by the transition from an ICE to an EV and will become obsolete. Examples of such parts include the engine, exhaust, cylinder head, crankshaft, fuel injection, etc.

Non-impacted: These are components that will remain unchanged (do not require any modification) in the event of transition from an ICE vehicle to an EV. The function of these parts remains 'identical' in both types of vehicles. Examples of such parts include body panels and suspension.

Repurposed: These are components from the ICE vehicle that can be adapted or reused in the EV with suitable modifications. These modifications are made to align the part's functionality with the EV's specific requirements. Examples of such parts include headlights and taillights.

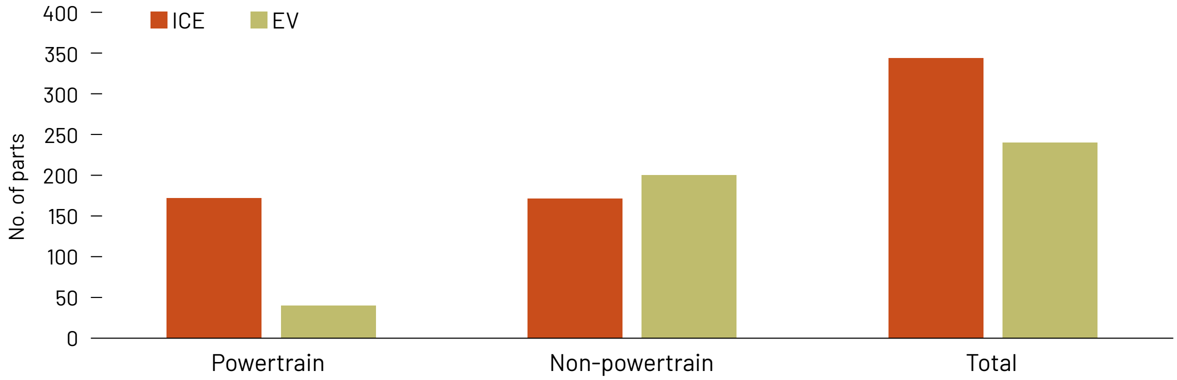
New parts: These are components unique to EVs. These parts are not present in an ICE vehicle and are designed and manufactured to fulfill the distinct needs of an EV. Examples of such parts include a traction motor, inverter, and motor controller.

2.1.1 Impact on two-wheelers

The powertrain of an ICE 2W has 156 parts/components, split between the engine and transmission assemblies. On the other hand, the powertrain in an electric 2W has just 25 components – 84% fewer components than the ICE 2W. During the transition, all the powertrain components of ICE will be impacted.

The number of non-powertrain components in an ICE 2W is 187, compared to 215 parts in an EV 2W. Overall, there are 15% additional non-powertrain components in an EV.

Figure 2.1: Parts in an ICE and EV 2W



Source: iFOREST analysis

Table 2.1: Overall impact assessment for 2W

Category	Baseline - ICE total parts (Nos.)	Parts that will become obsolete due to transition to EV (Nos.)	Overall impact		
			EV new parts (Nos.)	Total EV parts (Nos.)	Difference in parts (%)
Powertrain	172	160	28	40	-76.7
Non-powertrain	171	48	77	200	17.0
Overall	343	208	105	240	-30.0

Source: iFOREST analysis

Considering both powertrain and non-powertrain components, a transition from ICE to EV 2W will lead to the following impacts:

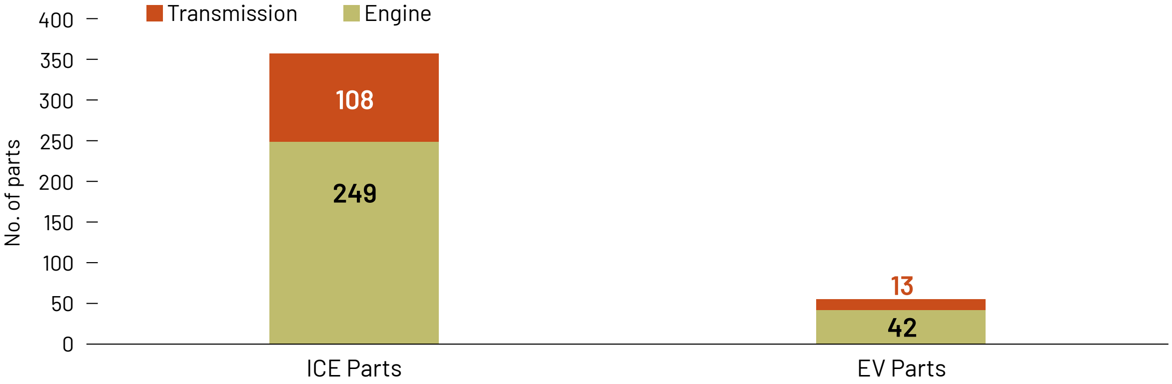
- 93% of powertrain components and about 28% of non-powertrain components of an ICE 2W will become obsolete.
- Overall, about 61% of parts an ICE 2W will become obsolete, while 39% of parts can be reused and repurposed in an EV 2W.
- An EV 2W has 84% less powertrain parts, but 15% more non-powertrain parts compared to an ICE 2W. In totality, an EV 2W has 30% less parts than an ICE 2W.

2.1.2 Impact on three-wheelers

The powertrain in an ICE 3W consists of 357 parts, split between the engine and transmission assemblies. Of these, 353 or 98.9% of total powertrain parts will become obsolete.

On the other hand, the powertrain in an electric 3W has 85% fewer components than the ICE 3W. It consist of 55 components of which 42 are under power module and 13 are under transmission assembly.

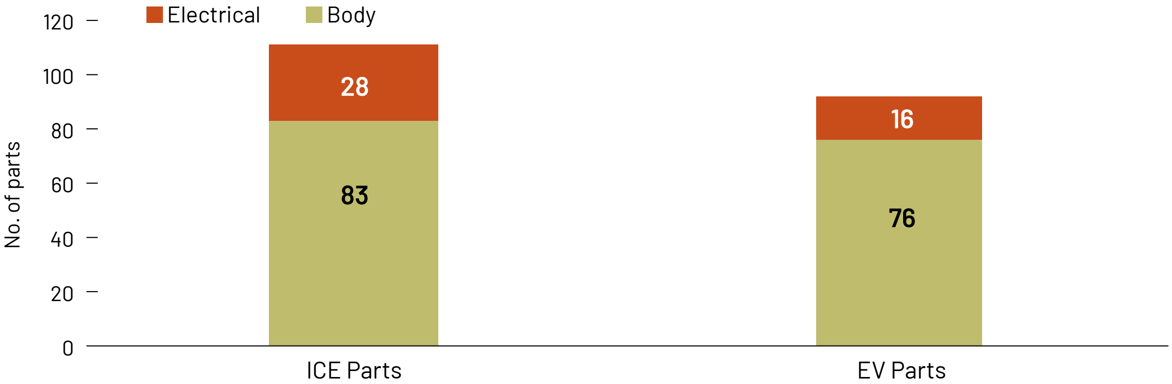
Figure 2.2: Powertrain parts of an ICE and EV 3W



Source: iFOREST analysis

The number of non-powertrain parts in an EV 3W is also less than in an ICE 3W. Whereas an ICE 3W has 111 parts, the EV 3W has 92 parts - 17% fewer non-powertrain parts compared to its ICE counterpart.

Figure 2.3: Non-powertrain parts for an ICE and EV 3W



Source: iFOREST analysis

Table 2.2: Overall impact assessment for 3W

Category	Baseline - ICE total parts (Nos.)	Parts that will become obsolete due to transition to EV (Nos.)	Overall impact			
			EV new parts (Nos.)	Total EV parts (Nos.)	Difference in parts (%)	Difference in cost (%)
Powertrain	357	353	51	55	-84.6	
Non-Powertrain	111	40	21	92	-17.1	
Overall	468	393	72	147	-68.6	-26.6

Source: iFOREST analysis

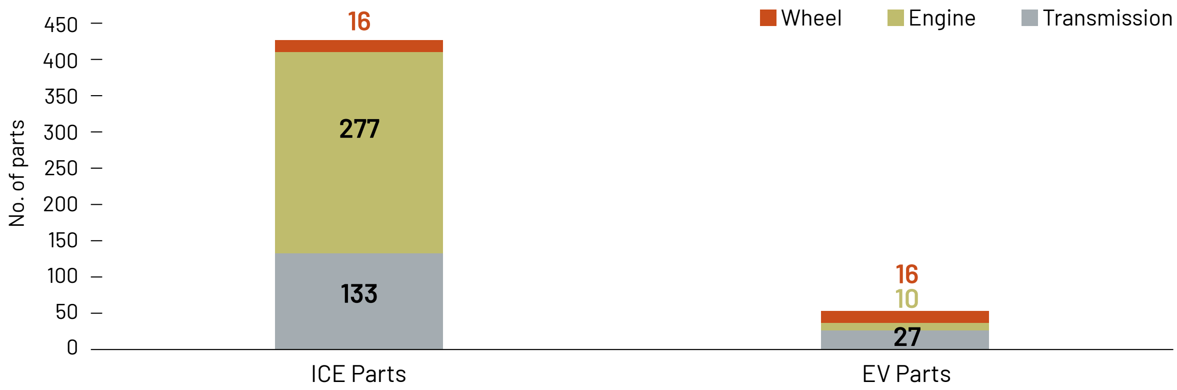
Overall, a transition from ICE to EV 3W will lead to the following impacts:

- An EV 3W will require 68.6% less parts than an ICE 3W.
- Also, 84.6% of the powertrain parts in an ICE 3W cannot be used in an EV 3W.
- Considering costs, an EV 3W is already 26% cheaper than an ICE 3W. This is precisely the reason for rapid penetration of EV 3Ws in the market.

2.1.3 Impact on cars

The powertrain in an ICE car consists of 426 parts, clubbed into three main assemblies – engine, wheel, and transmission. During the transition, a total of 388 powertrain parts or 91% of the total will become obsolete. On the other hand, the powertrain in an electric car has just 53 parts -- 87.6% fewer parts compared to an ICE car.

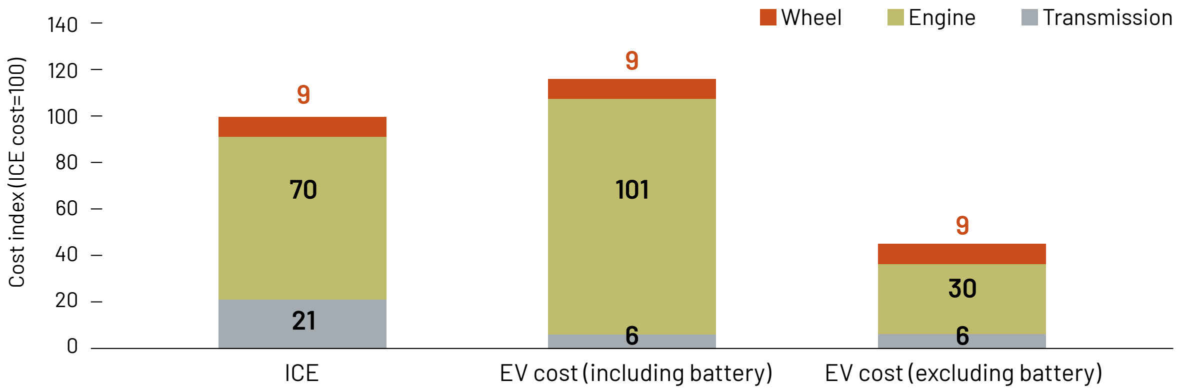
Figure 2.4: Powertrain parts in an ICE and EV car



Source: iFOREST analysis

Presently, the cost of the powertrain of an EV car, including the battery cost, is about 16% higher than an ICE car of similar make. Excluding the battery cost, the cost of the EV powertrain is less than half of ICE powertrain. Reduction in the battery cost, therefore, is the single most important factor in reducing the TCO of an EV car.

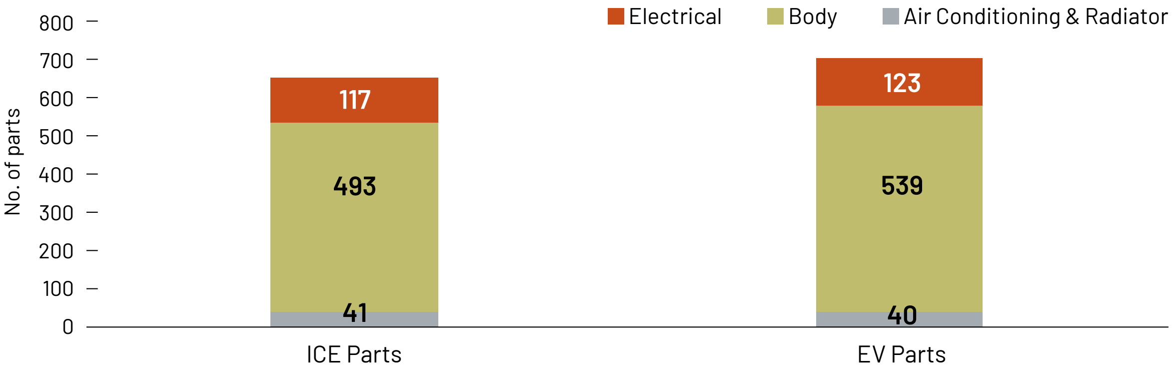
Figure 2.5: Powertrain cost of an ICE and EV car



Source: iFOREST analysis

The number of non-powertrain parts in an ICE car is 651 under three main assemblies: electrical, body, and air conditioning and radiator. In comparison, for an EV car, there are 702 non-powertrain components – about 8% higher than an ICE car.

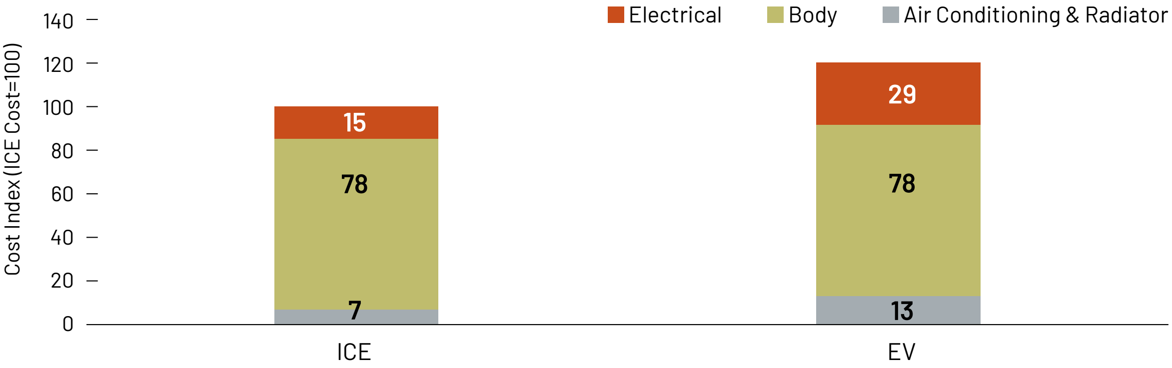
Figure 2.6: Non-powertrain parts in an ICE and EV car



Source: iFOREST analysis

Presently, the cost of the non-powertrain in an EV car is about 20% higher than its ICE counterpart. The higher cost is mainly due to expensive electrical, electronics and air-conditioning in an EV.

Figure 2.7: Non-powertrain cost for an ICE and EV car



Source: iFOREST analysis

Table 2.3: Overall impact assessment for cars

Category	Baseline- ICE total parts (Nos.)	Parts that will become obsolete due transition to EV (Nos.)	Overall impact			
			EV new parts (Nos.)	Total EV parts (Nos.)	Difference in parts (%)	Difference in cost (%)
Powertrain	426	388	15	53	-87.6	16
Non-Powertrain	651	78	129	702	7.8	19
Overall	1,077	466	144	755	-29.9	18

Source: iFOREST analysis

Overall, a transition from ICE to EV car will lead to the following impacts:

- Over 90% of the powertrain components and 12% of the non-powertrain components of an ICE car will become obsolete.
- Overall, about 45% of parts of an ICE car will become obsolete, while the remaining can be reused and repurposed in an EV car.
- An EV car has 88% less powertrain parts, but 8% more non-powertrain parts compared to an ICE car. In totality, an EV car has 30% less parts than an ICE 2W.
- In terms of cost, an EV car is about 18% more expensive largely due to expensive battery, electronics and air-conditioning systems.

2.2 Impact on auto component manufacturers

KEY FINDINGS

- About one-third of the biggest ACMs in India will be highly impacted by the transition. These are the ones involved in manufacturing parts and components of powertrain sub-assemblies of ICE vehicles, such as 'engine-fuel-exhaust', 'transmission', and 'driveline'.
- About 47% of the ACMs will be highly or moderately impacted by the transition to EVs.
- The largest number of the highly impacted enterprises are in Haryana, Maharashtra, and Tamil Nadu, which account for 60% of the highly impacted ACMs.
- In terms of the proportion of enterprises, Uttar Pradesh and Delhi NCR are the most impacted.

The transition from ICE vehicles to EVs will most significantly affect the manufacturing segment of the automobile industry due to changes in technology and the changing demands of parts and components. The impact will be most on the ACMs, as many of them will have to change their business or shut down. For instance, the sizable powertrain supplier industry will be transformed by the shift to EVs. There will also be a significant decline in spare parts and aftermarket activities resulting from the diminished number of wearable parts in the EV powertrain compared to an ICE powertrain.

To assess the impact of the EV transition on the ACMs, 729 enterprises which are members of the Automotive Component Manufacturers Association of India (ACMA) were studied to assess their vulnerability to the transition.

2.2.1 Methodology

Various components of ICE vehicles will experience different levels of impact as the automotive industry shifts towards EVs. Some components will become redundant, others may be adapted for EV use, and some can be directly transferred to EVs without modification. Consequently, manufacturers of these components will face varying degrees of impact. Manufacturers of components that will no longer be needed in EVs are expected to face greater challenges than those whose products are compatible with ICE and EV technologies. To assess the extent of the impact on these manufacturers, a methodology has been developed that involves assigning impact scores to different vehicle parts and components, which are then used to calculate the impact scores for the manufacturers. The impact scores range from 0 to 1, with scores above 0.6 indicating high vulnerability, between 0.3 and 0.6 suggesting moderate vulnerability, and below 0.3 indicating minimal impact. The methodology is detailed in the following steps:

1. Categorisation of 2W, 3W and car parts into 20 distinct powertrain and non-powertrain sub-assemblies.
2. Assigning impact scores to each sub-assembly, based on the impacts on each part in a sub-assembly:
   - Impacted: 1
   - Non-impacted: 0
   - Repurposed: 0.5

   Impact Score of sub-assembly = 1 * (% Impacted part) + 0.5 * (% Repurposed parts) + 0 * (% Non-Impacted parts)/(100)
3. Mapping of enterprises to identify parts produced by them and categorising them under various sub-assemblies. One enterprise can be involved in making products under multiple sub-assemblies and multiple vehicle categories (2W, 3W, car and CV).
4. Assigning scores to an enterprise based on the sub-assemblies and vehicle segment they are involved in.

   Impact Score of Enterprise = ∑ Impact Score of sub-assembly for (2W + 3W +Car +CV)/∆

   Where, ∑ is the summation of values, and ∆ is equal to:
   - *1 if the enterprise serves a vehicle segment*
   - *2 if the enterprise serves two vehicle segments*
   - *3 if the enterprise serves three vehicle segments*
   - *4 if the enterprise serves all vehicle segments*

2.2.2 Impact on ACMs

The study performs a detailed analysis of the impact of transition on the members of ACMA, the apex body representing India's auto component industry. They account for more than 85%[1] of the auto component industry's total turnover and comprise mostly medium and large companies, and largely organised sector.

The ACMA member base grew from 702 in 2014 to 845 in 2023, with significant expansion in the western and northern regions.

Table 2.4: Number of enterprises under ACMA

	2014	2023
Northern	312	377
South	152	174
East	34	31
West	203	263
Total	702	845

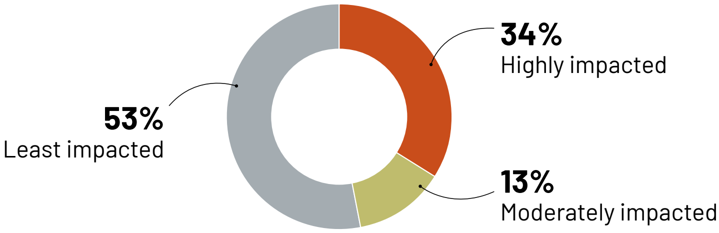
Source: ACMA annual reports for 2014 and 2023

Of the 845 enterprises, data on sub-assemblies was collected for 729 through secondary research. The enterprises were then mapped in different sub-assemblies and vehicle segments (CV, 2W, 3W, and Car).

The impact assessment of 729 large ACMs at a pan-India level suggests that a significant proportion of them will be highly or moderately impacted by the EV transition. Overall, the results of the impact assessment show that:

- About 34% of enterprises will be highly impacted by the transition. These are the ones involved in sub-assemblies that will be highly impacted by the EV transition. This includes sub-assemblies 'engine-fuel-exhaust', 'transmission', and 'driveline'.
- An additional 13% will be moderately impacted. These include enterprises involved in sub-assemblies whose parts can be repurposed for EVs.
- About 53% are likely to be least impacted by the transition. These include enterprises involved in sub-assemblies that broadly fall into the non-impacted category, such as 'body', 'general purpose parts', and 'moulding and process-based activities'. They also manufacture parts that can be repurposed.

Figure 2.8: Percentage of ACMs in each impact category



Source: iForest Analysis

Further, an analysis of the spatial distribution of these ACMs shows that they are primarily concentrated in six states - Haryana, Maharashtra, Tamil Nadu, Delhi, Uttar Pradesh, and Karnataka. These states account for 86% of the total sample. The largest number of highly impacted enterprises are in Haryana, Maharashtra, and Tamil Nadu. However, Uttar Pradesh and Delhi are most impacted by the proportion of enterprises.

Table 2.5: State-wise distribution of highly impacted ACMs

State	Total enterprises	No. of Enterprises - Highly impacted (>0.6 impact score)	Percentage of Highly Impacted Enterprises (%)
Uttar Pradesh	35	18	51.4
Delhi	60	24	40
Tamil Nadu	98	31	31.6
Haryana	202	63	31.2
Karnataka	53	16	30.2
Maharashtra	177	53	29.9
Others	104	42	40.4
Total	729	247	33.9

Source: iFOREST analysis based on ACMA members

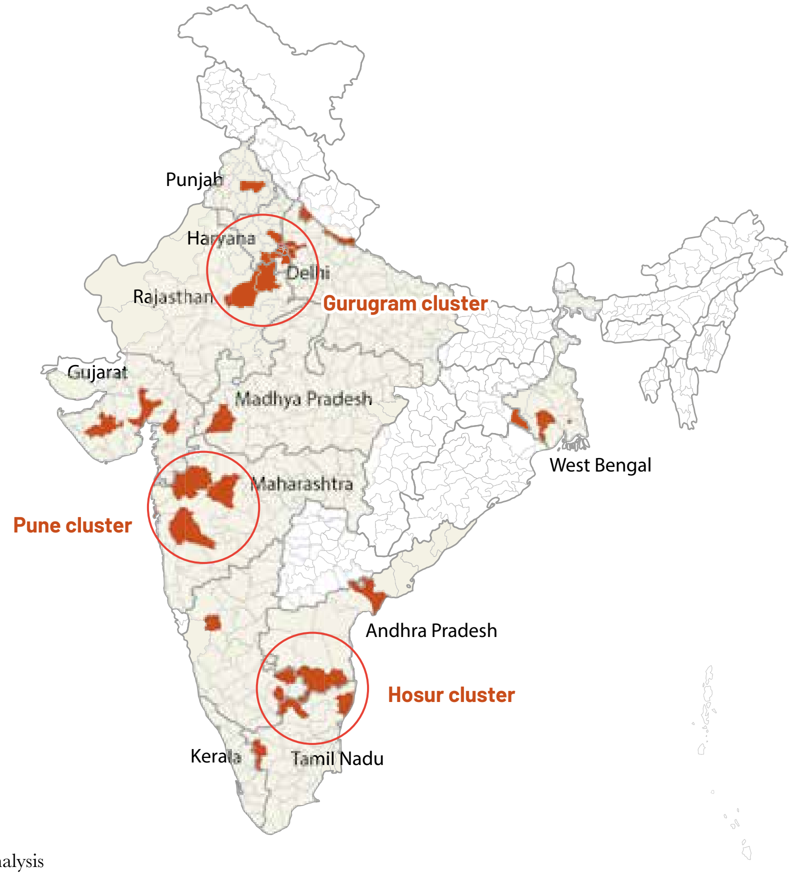
2.3 Impact on auto clusters

KEY FINDINGS

- The extent of impact differs across the clusters. In Gurugram, over 40% of enterprises are anticipated to face high to moderate levels of impact. Conversely, this figure ranges from 20% to 25% in Hosur and Pune.
- Additionally, in Gurugram, it is predominantly the larger and medium-sized companies that are expected to bear the brunt of the transition. In contrast, in Pune and Hosur, the MSMEs are most affected.
- Gurugram cluster, therefore, appears to be the most affected; however, the enterprises facing challenges are mostly larger or medium scale, which suggests they possess greater resources and capabilities to manage the transition. In contrast, despite a smaller percentage of enterprises in Hosur and Pune being highly or moderately impacted, the affected businesses are largely MSMEs, which are at a disadvantage due to limited financial and technological resources.
- ACMs have started transitioning to EV-related components. Overall, it was observed that 27% of enterprises in Gurugram, 21% in Hosur and 45% in Pune are currently supplying EV parts to OEMs. Further, 46% of enterprises in Gurugram, 34% in Hosur and 73% in Pune are willing to diversify into EVs.
- The primary survey shows that most enterprises are making a logical transition. They are expanding their business by supplying parts of the same sub-assembly for EVs. Only a small percentage were found to be transitioning/diversifying their business portfolio for manufacturing EV parts based on new opportunities in the EV ecosystem.

Automobile production in India is concentrated in certain regions due to a favourable business environment, access to markets, good infrastructure, and the availability of the required labour force. The regions, commonly referred to as the auto clusters, are located in various parts of the country. The largest clusters are located around Pune, Nashik, Aurangabad, and Mumbai in the west, Gurugram and Faridabad in the north, and Chennai, Coimbatore, and Hosur in the south.

Map 2.1: Automobile clusters in India



Source: iFOREST Analysis

The automobile clusters are typically characterised by a large concentration of micro, small and medium enterprises (MSMEs). These enterprises not only represent a major share of the auto manufacturing units but also have a large-scale employment dependence.

Three top auto clusters- Gurugram, Hosur, and Pune- have been considered to evaluate the impact of the EV transition at a cluster level. Besides regional diversity, the clusters also represent diversity in the scale and type of manufacturing enterprises.

The impact assessment of a cluster was done based on the assessments of all ACMs in the cluster. The information on ACMs was collected from various government and industry sources. The impact has been assessed for the enterprises following the impact assessment methodology, as discussed earlier (section 2.2.1). An overall impact score has been given to the enterprises, and based on that, the overall impact on the cluster has been determined.

Alongside evaluating impacts, an assessment has also been undertaken to understand the transition strategies that are being adopted (if any) or planned by the enterprises in response to the changing demands of the EV sector. This is based on the primary survey of enterprises in clusters. For this, 96 enterprises in Gurugram, 98 in Hosur, and 100 in Pune clusters were surveyed.

2.3.1 Cluster portfolio

The impact of the EV transition on a cluster will depend on the types of enterprises and their business portfolio. For instance, micro and small ACMs might face significant challenges during any abrupt transition to EVs due to their limited financial and technological capabilities. Moreover, companies focused on manufacturing ICE vehicle powertrain components, which are directly affected by the EV transition, could experience business downturns if they fail to adapt in time. Such setbacks can have implications for their employees.

a. Gurugram cluster

Gurugram cluster has 467 automobile enterprises. Of these, 72% are MSMEs, and the rest, 28%, are large enterprises. A sub-assembly-wise assessment of the enterprises shows that about 36% of the ACMs are involved in the production of powertrain components, and remaining 64% are primarily involved in the manufacturing of non-powertrain components.

Table 2.6: ACMs in the Gurugram cluster

Type of enterprises	Number
Large	130
Medium	131
Small	127
Micro	79
Total	467

Source: iFOREST analysis
Note: Data only for companies for which their products could be verified. The data were collated from the District Industrial Centre, the Labour Department of Haryana, the Manesar Industrial Welfare Association (MIWA) and the Automotive Component Manufacturers Association of India (ACMA).

The operation of these enterprises has also created significant employment dependence. Overall, over 121,000 workers are directly employed by the ACMs. About 56% are engaged in large enterprises, and about 24% are in medium enterprises. The rest are engaged in small and micro enterprises.

Table 2.7: Number of workers in ACMs of Gurugram cluster

Enterprise type	Number of workers
Large	68,448
Medium	29,702
Small	15,274
Micro	7,873
Total	1,21,297

Source: iFOREST analysis
Note: The classification of powertrain and non-powertrain for ACMs has been calculated based on their primary sub-assembly. Most ACMs are involved in more than one sub-assembly; the primary sub-assembly decision has been made based on extensive primary and secondary research on their product portfolio.

b. Hosur cluster

The Hosur cluster, located on the border of Karnataka and Tamil Nadu, is one of the major automobile clsters of the south. There are about 759 ACMs in the Hosur cluster, of which more than 95% are MSMEs. A sub-assembly-wise assessment of enterprises operating in the cluster shows that about 15% of the ACMs are involved in the production of powertrain parts. The remaining 85% are primarily involved in manufacturing non-powertrain components. Of those manufacturing non-powertrain components, close to 60% are involved in moulding and process-based work.

Table 2.8: ACMs in the Hosur cluster

Type of enterprises	Number
Large	35
Medium	26
Small	609
Micro	89
Total	759

Source: iFOREST analysis
Note: Hosur data has been collated from DIC Krishnagiri, the Hosur Industries Association (HIA), the Hosur Micro Industrial Association (HOSMIA), the Hosur Small & Tiny Industries Association (HOSTIA), SIPCOT, and SIDCO.

Over 35,413 workers are directly employed by the ACMs. About 52% are engaged in large enterprises, and about 16% are in medium enterprises.

Table 2.9: Number of workers in ACMs of Hosur cluster

Enterprise type	Number of workers
Large	18,456
Medium	5,575
Small	3,774
Micro	7,608
Total	35,413

Source: iFOREST analysis

c. Pune cluster

Pune is the largest auto hub in India and among the oldest. It has over 6,800 ACMs. Besides, there are 23 OEMs located in this cluster. The cluster is dominated by micro and small enterprises, constituting about 96% of the ACMs. A sub-assembly-wise assessment shows that about 18% of the ACMs are involved in the production of powertrain components. The remaining 82% are primarily involved in manufacturing non-powertrain components. Among them, more than 52% of the ACMs are involved in 'moulding and process-based activities' and 'general purpose' sub-assemblies .

Table 2.10: ACMs in the Pune cluster

Type of enterprises	Number
Large	61
Medium	213
Small	1,606
Micro	4,974
Total	6.854

Source: iFOREST analysis
Note: Pune data has been collated from DIC, Pune.

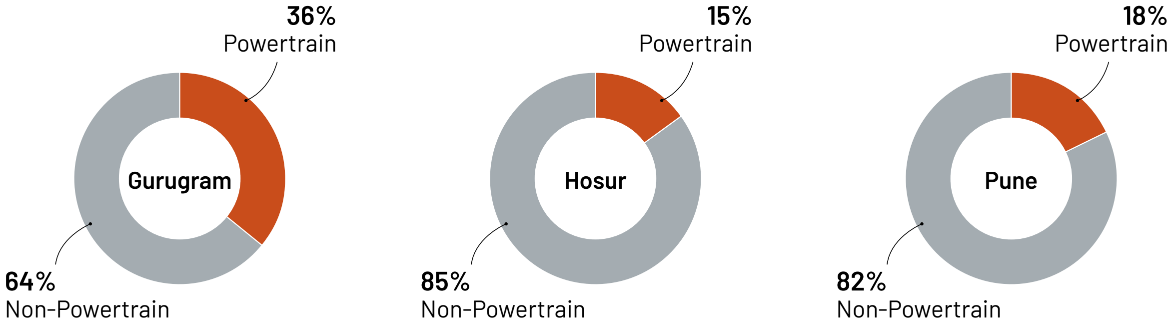
There are about 123,759 workers who are directly engaged by the ACMs. Besides, over 88,000 workers are employed by the OEMs.

Table 2.11: Number of workers in Pune cluster

Enterprise type	Number of workers
Large	26,501
Medium	27,744
Small	39,249
Micro	30,265
Total	123,759

Source: iFOREST analysis based on data from DIC, Maharashtra

Figure 2.9: Cluster-wise powertrain and non-powertrain profile (%)



Source: iFOREST

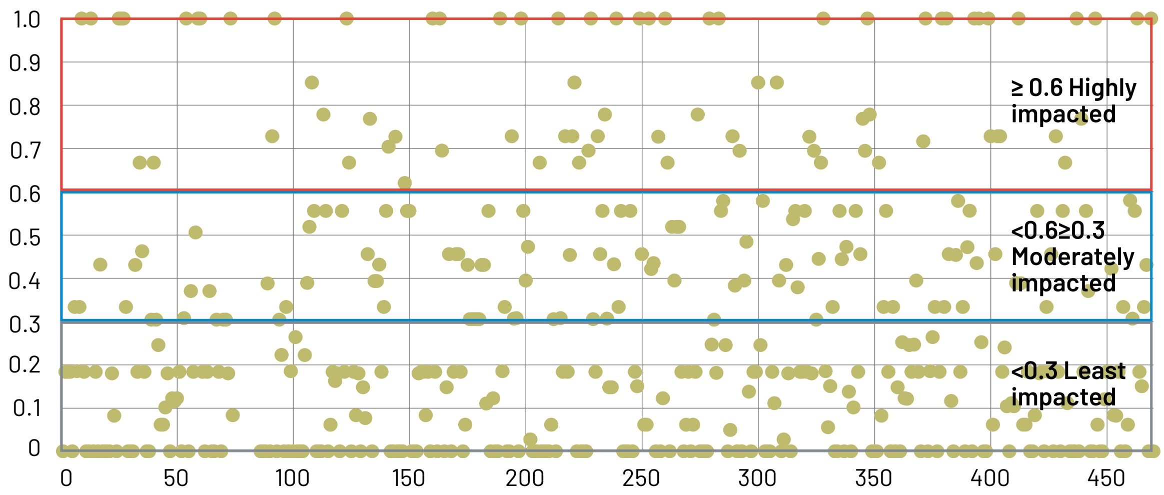
2.3.2 Cluster-level impact

The impact on clusters, as discussed earlier, has been assessed by deriving an impact score based on the product portfolio of the enterprises (see section 2.2.1).

The impact assessment for the Gurugram cluster shows that about 17% of the ACMs will be highly impacted by the transition. In addition, another 25% will be moderately impacted. So, overall, about 42% of the enterprises will be highly and moderately impacted.

The enterprises in the high and moderately impacted category mainly large and medium scale. For instance, in the highly impacted category, 41% are large, 31% are medium, and 28% are small and micro enterprises.

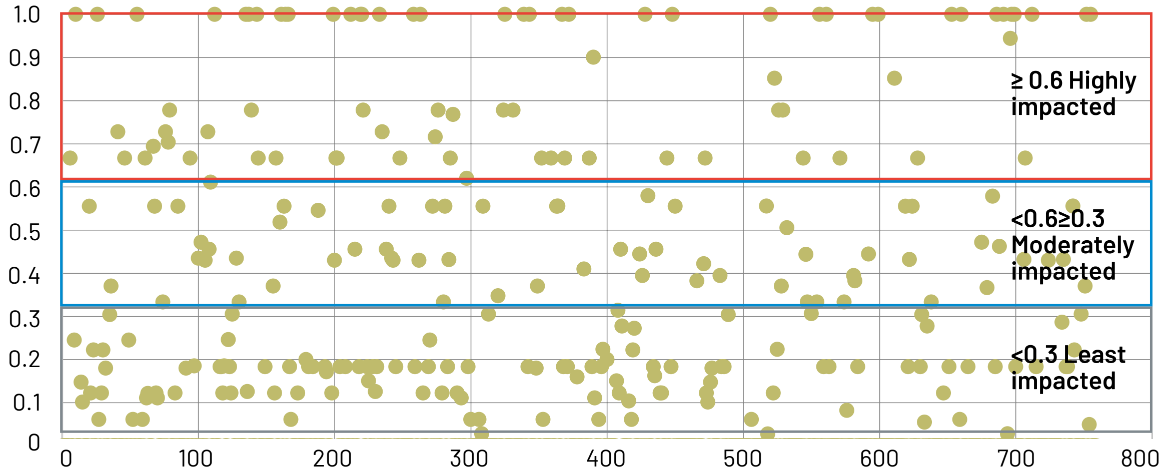
Figure 2.10: Impact assessment of ACMs in the Gurugram cluster



Source: iFOREST analysis

In the Hosur cluster, around 11% of the ACMs will be highly impacted and 9% will be moderately impacted by the transition. So, about 80% of the enterprises in the cluster are in the non-impacted category. Most of the enterprises in the high and moderately impacted category are small and micro enterprises.

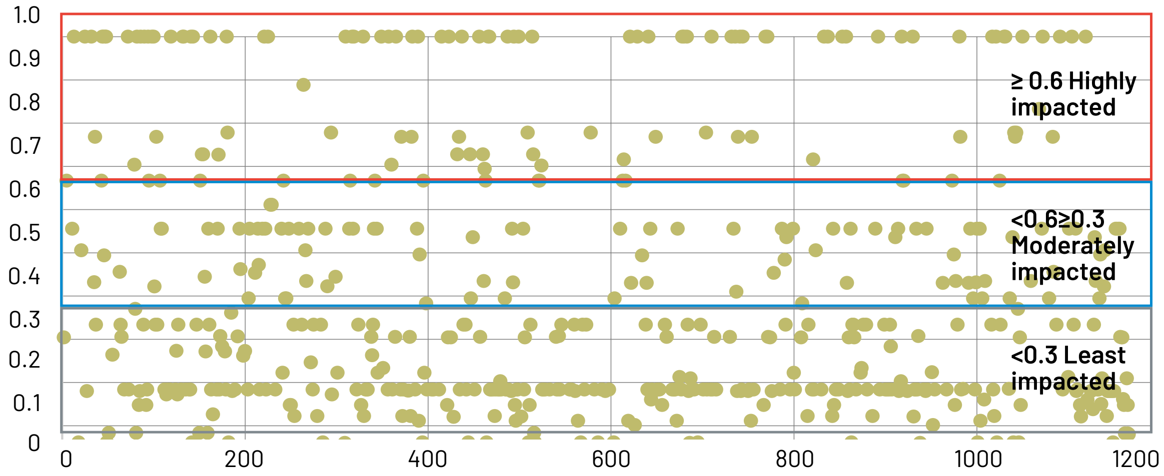
Figure 2.11: Impact assessment of ACMs in the Hosur cluster



Source: iFOREST Analysis

For the Pune cluster, the analysis shows that around 11% of the ACMs will be highly impacted by the transition, and another 14% will be moderately impacted. So, about one-fourth of the enterprises are in the high and moderately impacted category. A large majority of these enterprises are from the MSME sector

Figure 2.12: Impact assessment of ACMs in the Pune cluster



Source: iFOREST analysis

The evaluation of three clusters, taking into account potential impacts and their specific characteristics, leads to the following conclusions:

- The extent of impact differs across the clusters. In Gurugram, over 40% of enterprises are anticipated to face high to moderate levels of impact. Conversely, this figure ranges from 20-25% in Hosur and Pune.
- Additionally, in Gurugram, it is predominantly the larger and medium-sized companies that are expected to bear the brunt of the transition. In contrast, in Pune and Hosur, the MSMEs are most affected.
- Gurugram's cluster, therefore, appears to be the most affected; however, the enterprises facing challenges are mostly of larger or medium scale, which suggests they possess greater resources and capabilities to manage the transition.
- In contrast, despite a smaller percentage of enterprises in Hosur and Pune being highly or moderately impacted, the affected businesses are largely MSMEs, which are at a disadvantage due to limited financial and technological resources. A crucial strategy for supporting MSMEs could involve targeted technological assistance and training programs, developed in collaboration with larger ACMs or OEMs.

2.3.3 Transition preparedness

Transition preparedness was assessed based on the primary survey of close to 300 enterprises in the three clusters. The survey findings indicate that ACMs have started transitioning to EV-related components. Overall, it was observed that 27% of enterprises in Gurugram, 21% in Hosur and 45% in Pune are currently supplying EV parts to OEMs. Further, 46% enterprises in Gurugram, 34% in Hosur and 73% in Pune are willing to diversify into EVs.

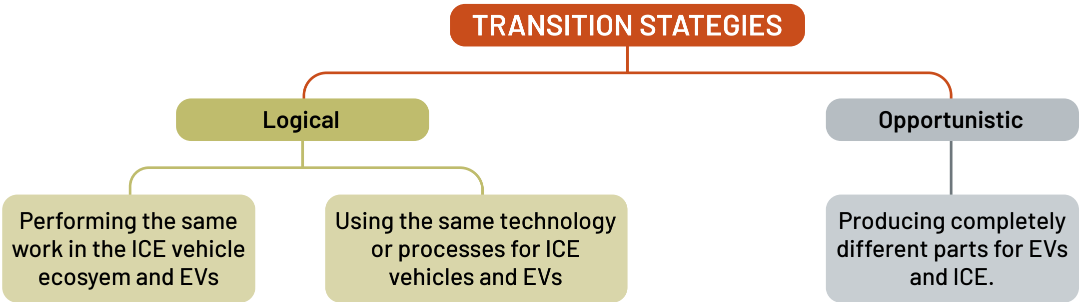
Table 2.12: Transition readiness of enterprises

	Gurugram	Hosur	Pune
Percentage of sample currently producing parts for EVs (%)	27	21	45
Percentage of sample willing to diversify into EV business (%)	46	34	73

Note: This analysis is based on a sample survey in three clusters. The two data points are not mutually exclusive.

An ACM that provides parts for ICE vehicles may also cater to EVs within the same sub-assembly, ensuring a smooth continuity of its operations. This approach can be described as a 'logical transition'. Alternatively, an ACM may choose to shift its focus to a completely different sub-assembly for EVs, marking a substantial departure from its original business. This strategic shift can be referred to as an 'opportunistic transition'.

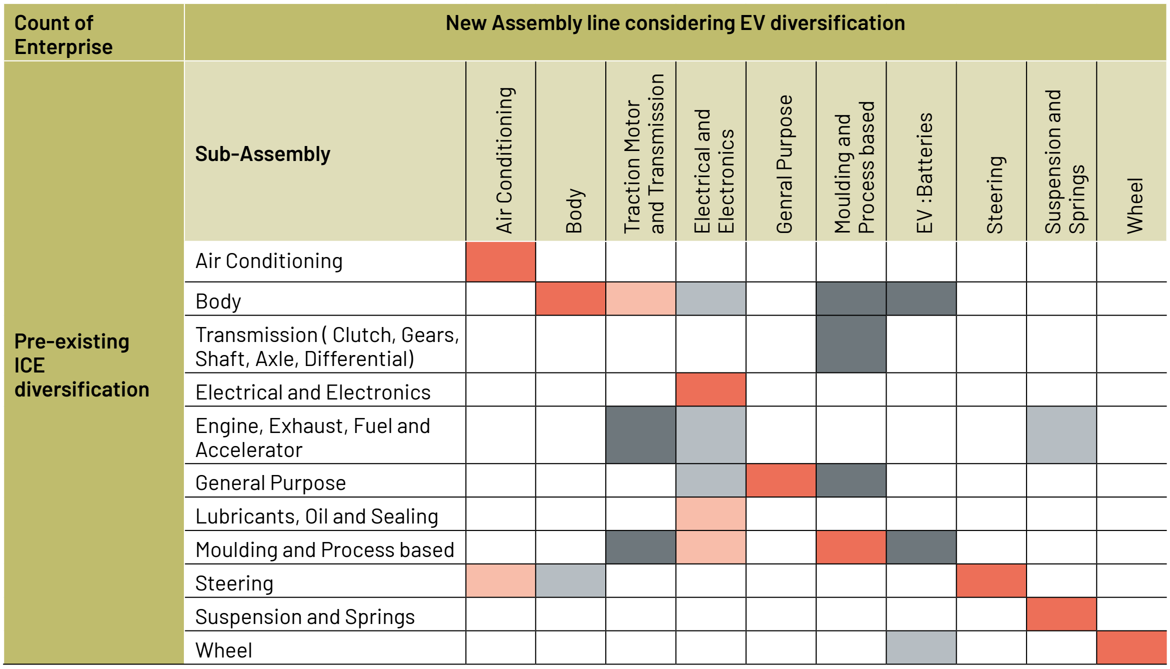
Figure 2.13: Transition strategies



Source: iFOREST analysis

The survey shows that most enterprises are making a logical transition. They are expanding their business by supplying parts of the same sub-assembly for EVs. Only a small percentage were found to be transitioning/ diversifying their business portfolio for manufacturing EV parts based on new opportunities.

Figure 2.14: Transition matrix



(pure logical transition): by performing exactly the same work.

(logical transition): working on a similar kind of application or technology.

(logical transition): Already parallel or secondary involvement in the transition area. Expanding that sector in the EV domain.

(opportunistic transition): Transition may be based on opportunities instead of their previous manufacturing expertise.

Source: iFOREST Analysis based on a survey of 294 enterprises in Hosur, Pune and Gurugram clusters

Overall, the assessment of the transition strategy of ACMs suggests the following:

- The enterprises undergoing a logical transition are primarily small and micro. This is also a natural process for them as these enterprises also cater to various non-auto industries based on product requirements.
- The enterprises that are doing opportunistic transition are primarily medium and large enterprises.
- Enterprises specialising in manufacturing body parts for ICE vehicles are leveraging their expertise in processes and materials to enter the production of EV battery components.
- Enterprises involved in manufacturing body parts for ICE vehicles are exploring opportunities in moulding and process-based activities for both ICE and EV components.
- Enterprises manufacturing ICE vehicle body parts are extending their capabilities to produce precision components, such as rotors, for EV motors. This transition leverages similar applications and manufacturing processes.
- Enterprises producing high-precision parts for engines and exhaust systems are applying similar processes to manufacture components for EV transmission and traction motors, building on their existing expertise.
- Enterprises primarily engaged in moulding and process-based manufacturing, including home appliance production, are diversifying into the EV market by expanding into electrical and electronic components.

2.4 Impact on workforce

KEY FINDINGS

- About 31% of the job roles in the ICE ecosystem will be affected – 14% will become obsolete and 17% will require reskilling.
- Maximum job roles will be affected in ICE manufacturing. Out of the total 304 job roles, 21.4% will become obsolete.
- Overall, there will be an increase in job roles in the transition from ICE vehicles to EVs. While 66 job roles will become obsolete, 93 new job roles will be created.
- The new job roles in the EV ecosystem are qualitatively different from the existing job roles requiring high skills and education levels. For job roles that will not become obsolete, reskilling workers will be necessary to adapt to new technologies.
- While the number of jobs supported by EVs are slightly lower than ICE vehicles, there will be net increase in jobs in the automobile sector due to EV penetration.

The automobile sector is the third largest employer in the manufacturing sector accounting for 9.58% of employment after food products (11.05%) and textiles (9.64%)[2]. The sector is estimated to employ about 30.7 million people considering direct (13.7%) and indirect employment (86.3%).[3]

While the shift from ICE vehicles to EVs, supported by government policies and industry targets, is going to revolutionise India's automobile sector in the coming years, it will have implications for a large proportion of the workforce currently engaged in the manufacturing of ICE vehicles, as well as those engaged in the downstream value chain such as servicing and repairs. The digital transformation in the automobile industry will require a new set of skills from manufacturing to servicing. Therefore, a key consideration for the EV transition will be to ensure a planned transition of the existing workforce engaged in the ICE vehicle ecosystem to the EV ecosystem. Simultaneously, there will be a need for the development of a new workforce.

To assess the impact on the workforce, iFOREST undertook a detailed study including a primary survey in three major automobile clusters -- Pune (in Maharashtra), Hosur (in Tamil Nadu), and Gurugram (in Haryana). The primary survey involved, a survey of 300 ACMs and a total of 1,184 workers in the three clusters, and interviews with OEMs, such as Mahindra, Tata Motors, Maruti, TVS, and Force Motors.

Further, a comprehensive analysis of all job roles in the automobile ecosystem was done considering various secondary data sources, including the National Qualification Register,[4] and National Classification of Occupations (NCO) codes (mapped with 17 National Industrial Classification (NIC) codes identified for the auto sector).[5] The job roles were further verified during meetings with OEMs and ACMs to arrive at an exhaustive list for impact analysis.

The research specifically investigated the types of jobs that will be impacted, including those that will become redundant or obsolete in the EV ecosystem, the type of jobs that can be retained through timely reskilling, and the new job opportunities that will be created by the EV transition.

Table 2.13: Distribution of ACM workers surveyed

Cluster	Large	Medium	Micro	Small	Cluster total
Hosur	56	90	149	124	419
Gurugram	46	117	37	115	315
Pune	10	104	173	163	450
Total workers	112	311	359	402	1,184

Source: iFOREST analysis

2.4.1 Workforce profile

The workforce was analysed to provide an understanding of the following aspects:

i. Types of workers

ii. Education levels; and,

iii. Skill levels.

The assessment shows that the largest share of workers in the ACMs are contractual workers. These include a sizable proportion of workers who do not have any employer-provided benefits. Besides, there is a significant proportion of informal workers. Overall, contractual, and informal workers constitute nearly two-thirds (66%) of the workers in ACMs. The informality is higher in micro and small enterprises. In OEMs, however, the proportion of formal workers is much higher, as was shared by officials during interviews.

Table 2.14: Workforce distribution in ACMs

Type of employment	Share (%)
Permanent employees	34.6
Contractual workers	37.5
Causal labour/daily wager	28.6
Self-employed	0.9 %

Source: iFOREST analysis

For education levels, a large proportion of the workforce (95%) has completed secondary education. More than 38% of workers also have completed Industrial Training Institute (ITI) courses, or have other diploma/certification across different enterprise sizes. Close to half of all the workers working in large and medium enterprises have done ITI courses or have other diploma/certification.

Table 2.15: Education level

Education level (% of workers)	Large	Medium	Small	Micro	Total
Not literate	0	1.6	1.2	0.6	1
Middle education, up to 8th class	2.7	3.2	4.5	4.5	3.9
Secondary education, up to 10th class	9.8	19	16.7	34.8	21.4
Higher secondary education (up to 12th Class)	14.3	14.5	26.1	24.5	22.1
ITI/Diploma/ Certification course	52.7	46	37.3	30.1	38.8
Graduate	19.6	14.5	12.9	5.3	11.7
Post-graduate	0.9	1.3	1.2	0.3	0.9

Source: iFOREST analysis

The majority of the workforce in the auto sector is also semi-skilled or skilled. However, a large proportion of the workforce (80%) relies on on-the-job learning or training. Only 7% of workers were found to have completed formal vocational training.

Table 2.16: Training of workforce

Training level (% of workers)	Large	Medium	Small	Micro
Did not receive any vocational Training	9.8	5.8	8	4.2
Formal vocational training	0.9	10.6	10.7	1.7
On-the-job learning/training	85.7	72.3	76.1	88.9
Self-learning	3.6	11.3	5.2	5.3

Source: iFOREST analysis

Overall, the assessment of the workforce profile shows that a large proportion of workers in ACMs are contractual or informal workers, possess education and skills, and depend on on-the-job training. While the

informal status of their employment presents a risk to job security, their educational background and skill set offer them the capability to adapt to new opportunities. Consequently, developing a transition strategy for the workforce is crucial for the automobile industry.

2.4.2 Assessment of job roles

The assessment of job roles in the ACMs and OEMs has been done based on secondary research and interviews with representatives of ACMs and OEMs. The analysis shows that there are at least 564 job roles in the entire automobile sector. More than 50% of job roles are in manufacturing (considering both OEMs and ACMs), where a majority of workers are directly employed in the auto industry. The second largest number of job roles are in service/repair (15.9%). Overall, manufacturing and service/repair account for 70% of all the job roles in the sector.

Table 2.17: Category-wise job roles of auto ecosystem

Categories of auto ecosystem	Number and share of job roles
Manufacturing	304 (53.9%)
Service/repair	90 (15.9%)
R&D	75 (13.3%)
Dealership	59 (10.5%)
EV charging stations/fuel pumps	21 (3.7%)
Supply chain and logistics	15 (2.6%)
Total	564 (100%)

Source: iFOREST analysis
Note: Job role is not equal to the job. An individual can have more than one job role.

ICE *VS* EV MANUFACTURING

A sub-assembly-wise comparative assessment of job roles in the manufacturing segment of ICE vehicles and EVs shows that the total number of job roles will increase slightly in the case of EVs. The new job roles will be created in battery manufacturing and EV motors, while job roles in engine, fuel, and exhaust in the ICE vehicles will be impacted.

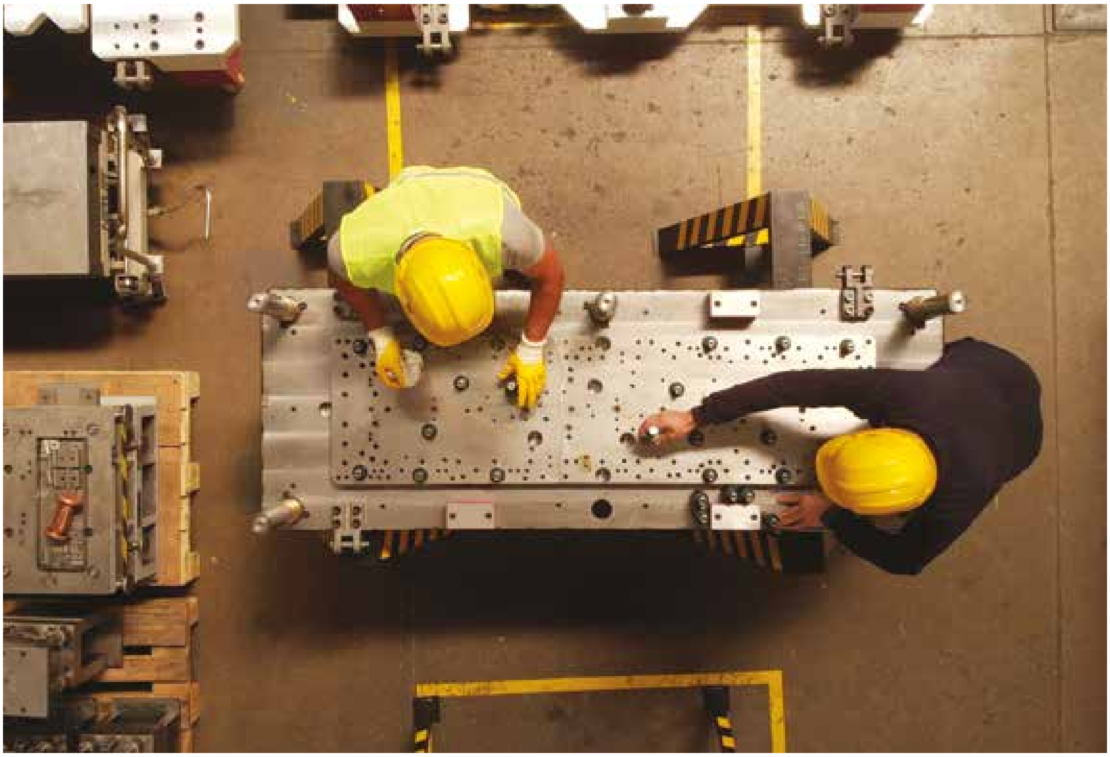


Table 2.18: Sub-assembly-wise job roles in the manufacturing segment

Job roles	ICE	EV
Battery		37
Body and chassis	89	88
Design	9	11
Driveline	11	11
Electronics and control systems	5	8
Engine	31	
EV motor		7
Fuel system and exhaust	9	
General purpose components and assembly line job roles	33	32
Machining job roles	34	34
Plant and equipment maintenance	10	11
Transmission	12	12
Total	243	251

Source: iFOREST analysis

The education and skill levels of workers as per the job roles (564) have been further evaluated considering the National Skills Qualification Framework (NSQF). The analysis shows that most of the auto sector workforce falls between NSQF levels 4 and 5. These two levels generally represent jobs such as operators/technicians and managers. People working at NSQF 4 and 5 also have at least a higher secondary level education. Ideally, most of them are graduates, including those completing courses from polytechnic institutes or ITIs. Around two-thirds of the auto sector job roles are between these two categories.

Table 2.19: Total number of job roles in the auto ecosystem according to NSQF levels

NSQF levels	Examples of auto job roles	Number of job roles		
		Non-manufacturing	Manufacturing	Auto ecosystem total
Level 2	Press shop assistant/ helper, automotive washer	13 (2.2%)	20 (6.6%)	33 (2.6%)
Level 3	Mechanical assembles	21 (5.3%)	19 (6.2%)	40 (4.8%)
Level 3.5	Toolroom operator, die maker	9 (2.7%)	39 (12.8%)	48 (6.8%)
Level 4	Press operator, technicians	77 (26.2%)	82 (26.9%)	159 (25.7%)
Level 4.5	Production in charge	25 (9.5%)	13 (4.3%)	38 (6.9%)
Level 5	Quality control engineer	58 (24.6%)	108 (35.5%)	166 (33.6%)
Level 5.5	Sales manager	5 (2.3%)	5 (1.6%)	10 (2.22%)
Level 6	Designer, chip programmer	46 (23.4%)	18 (5.9%)	64 (15.53%)
Level 7	Regional manager	6 (3.6%)	0	6 (1.7%)
Total		**260 (100%)**	**304 (100%)**	**564 (100%)**

Source: iFOREST analysis

2.4.3 Impact on job roles

The impact on job roles provides a detailed understanding of the types of jobs that will become redundant/ obsolete due to the EV transition, the jobs that can be retained through timely reskilling and skilling interventions, and the new opportunities that will arise for which workers will need to be trained.

IMPACT CATEGORIES

Jobs that may become obsolete: This includes job roles in assembly lines mainly of engine assembly, fuel tank and exhaust, and service and engine-repair-related job roles.

Jobs that can be retained through reskilling: This includes job roles in areas such as vehicle system engineering, software-related roles, transmission, and axles assembly line as well as service-oriented positions such as brake systems, maintenance, and the manufacturing of vehicle bodies and components.

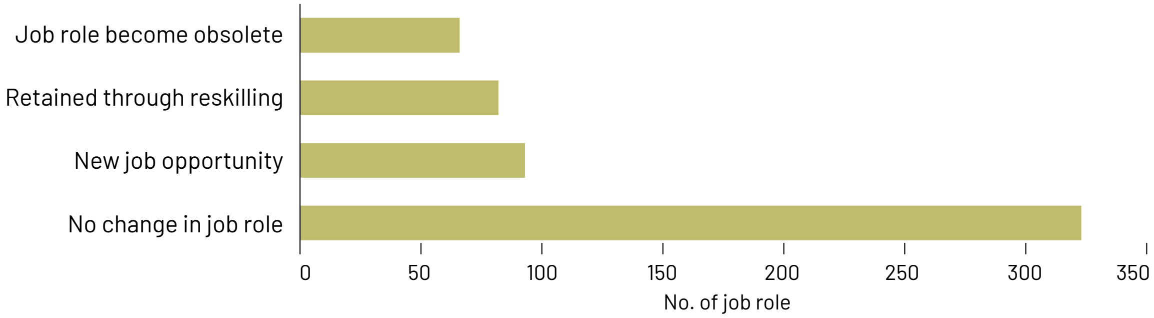
New job opportunities due to EV transition: This includes job roles in areas, such as comprehensive battery management, the establishment and operation of charging infrastructure and stations, manufacturing battery components, expertise in digital technology, and servicing electronic and electrical components, among others.

No change: This category includes overlapping job roles between ICE vehicles and EVs. These are job roles that will not be affected by the transition towards EV, as the employees/workers can continue to perform the same work as in the ICE value chain.

The analysis shows that about 31% of the job roles in the ICE ecosystem will be affected – 14% will become obsolete and 17% will require reskilling. Maximum job roles will be affected in ICE manufacturing. Out of the total job roles in ICE manufacturing, 21.4% will become obsolete. This includes jobs like carburetor technicians, clutch system specialists, and exhaust system inspectors, among others. Further 12.3% of jobs in the segment will require major reskilling interventions. These include jobs in sub-assemblies such as transmission and drive lines, among others.

In the non-manufacturing segment, however, only 5% of the job roles will become obsolete.

Figure 2.15: Impact on job roles due to EV transition



Source: iFOREST analysis

Overall, both in the manufacturing and the non-manufacturing segments, while a total number of 66 job roles will become obsolete, 93 new job roles will be created. Therefore, more new job opportunities will be created in the EV ecosystem.

Table 2.20: Comparative evaluation of job role in ICE and EV ecosystem and impacts

Job role status	Manufacturing		Non-manufacturing		Auto ecosystem	
	ICE	EV	ICE	EV	ICE	EV
Job roles may get obsolete	52	0	14	0	66	0
Retained through reskilling	31	31	51	51	82	82
New job opportunity	0	60		32	0	92
No change in job role	160	160	163	163	323	323
Total	**243**	**251**	**228**	**246**	**471**	**497**

Source: iFOREST analysis

However, an assessment of job roles as per the NSQF shows that the new jobs that will be created in the EV ecosystem are highly skilled. For example, at Level 2 while over 10.6% of job roles will become obsolete, only 2% new job roles will be created. Most of the new job roles will be created at Level 5 and Level 6, which require higher levels of skills and education.

Table 2.21: Impact assessment on job roles as per education and skills

NSQF levels	Obsolete Job roles (% of total jobs at the NSQF level)	New job roles (% of total jobs at the NSQF level)
Level 2	10.6	2.1
Level 3	6.1	1.1
Level 3.5	1.5	5.4
Level 4	36.4	30.1
Level 4.5	12.1	7.5
Level 5	25.8	36.6
Level 5.5	6.1	2.1
Level 6	1.5	15.1
Total	**100**	**100**

Source: iFOREST analysis

2.4.4 Impact on employment

To estimate the impact on employment, a detailed study was conducted on cars (passenger cars). The following methodology was adopted to estimate the number of jobs in OEMs and ACMs:

i. A primary survey was conducted at an OEM producing both ICE and EV cars of similar make to estimate the number of workers employed and develop a job factor (jobs per vehicle) at the OEM level.

ii. For ACM, job factors were developed separately for powertrain and non-powertrain components for an ICE vehicle and EV car.

   a. Firstly, the Annual Survey of Industries (ASI), 2021-22 was used to arrive at the jobs coefficient (jobs per INR crore output). NIC codes for the ACMs (29301, 29302, 29303, 29304, and 29104) and battery manufacturing (27201 and 27202) were used to filter data from ASI and arrive jobs coefficient for the powertrain and non-powertrain of ICE and EV cars.

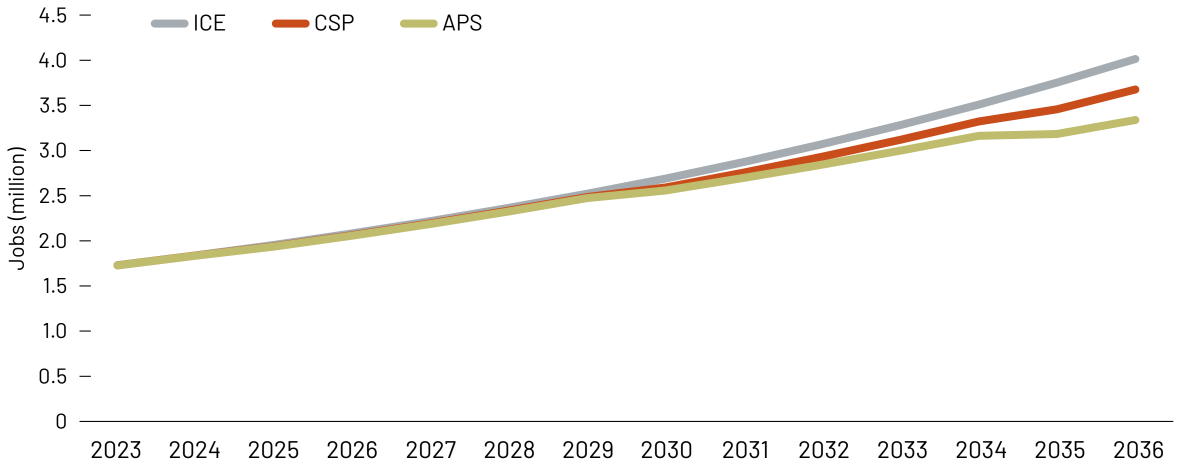
   b. The jobs coefficient was then extrapolated with the cost of the powertrain and non-powertrain components of ICE and EV cars (see Section 2.1.3) to develop the job factors.

iii. Estimating the number of jobs considering two scenarios, the CPS and APS (see Section 1) till 2036-37. The CPS and APS scenarios were compared with a scenario in which it was assumed that only ICE cars were produced (ICE Scenario).

The key observations of the scenario analysis include the following:

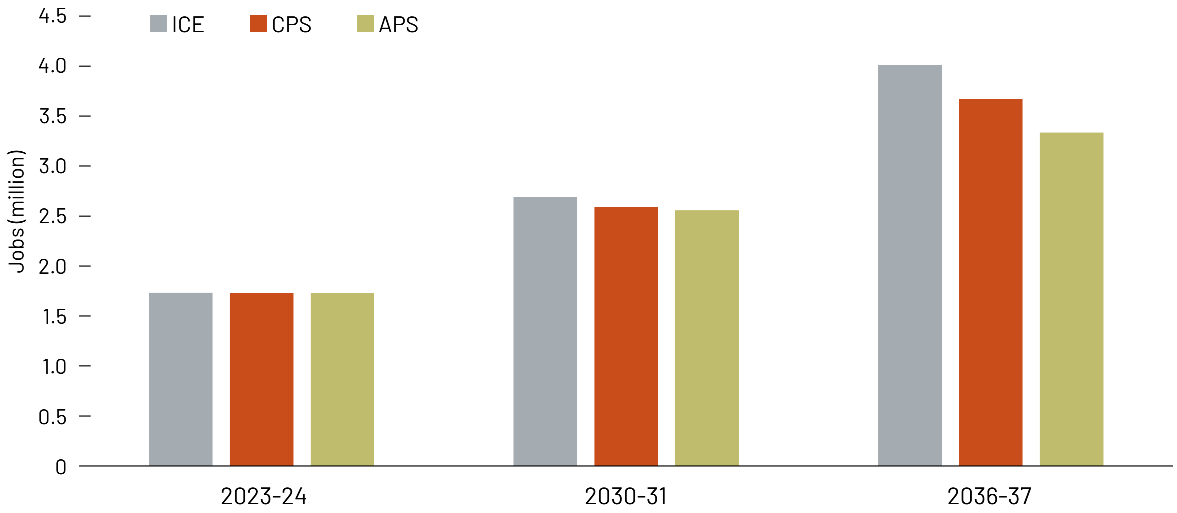
- At the OEM level, the job factor in ICE is about 20% higher than EV.
- At the ACM level, the job factor in the powertrain of an ICE car is about 10% higher than that in the powertrain of an EV. The job factor in the powertrain of EVs is projected to reduce due to the economy of scale and automation.
- At the ACM level, the job factor in the non-powertrain of an ICE and an EV car is the same. However, the job factor in the non-powertrain of EVs is projected to reduce due to the economy of scale and automation.
- The total number of jobs in passenger car manufacturing is projected to grow from 1.7 million in 2023-24 to 2.6 million in 2030-31 and 3.3-3.7 million in 2036-37. Therefore, there is no job loss per se due to the transition from ICE to EV.
- However, the number of jobs created in CPS and APS scenarios is lower than those in the ICE scenario. In 2036-37, 8–17 percent fewer jobs would be created than in ICE. Thus, the number of jobs supported by EVs is relatively lesser than ICE.

Figure 2.16: Impact on jobs in various scenarios



Source: iFOREST analysis

Figure 2.17: Impact on number of jobs



Source: iFOREST analysis

2.4.5 Overall observations

The assessment of the impact on the workforce due to the transition from ICE vehicles to EVs shows that about 31% of the job roles in the ICE ecosystem will be affected. This includes 14% (total 66) job roles that will become obsolete and 17% will require reskilling. On the other hand, 92 new job roles (18% of the EV job roles) will be created due to the transition to EVs. Overall, the number of job roles in the EV ecosystem is about 5% higher than in the ICE ecosystem. However, the new job roles are qualitatively different than the existing job roles, as they require high skills and education levels.

Even for job roles that will not become obsolete, new skill sets will be required to retain workers in those roles. Therefore, skilling and reskilling of the workforce will be one of the most important interventions for the EV transition. While the number of jobs supported by EVs is slightly lower than ICE vehicles, there will be a net increase in jobs in the automobile sector due to the penetration of EVs. For example, the number of jobs in the manufacturing of passenger cars is likely to at least double by 2036-37.

To ensure a just transition of the workforce, a broad-based intervention of reskilling and job creation through government support and industry investments will be necessary. Overall, a comprehensive strategy of skilling and reskilling aligning with the evolving technology and demands of the EV ecosystem will be required.

03

Policy Landscape of the Automobile Sector

KEY FINDINGS

- There are important policies and schemes of the GoI that are in place to increase the adoption of EVs, support infrastructure development, and boost domestic manufacturing, among others.
- Various state governments have also adopted policies to support the transition from ICE to EVs, specifying targets for EV penetration.
- The policy environment, however, remains fragmented with various ministries and departments involved in developing policy measures to support some of the central schemes.
- A key focus of the policies is generating demand for personal EVs through demand-side incentives. While this is important, however, if simultaneously green and efficient public transport is not ramped up, it can lead to congestion and compromise urban sustainability.
- Policies to promote domestic manufacturing, such as the PLIs, are focused on high-value manufacturing. The ability of MSMEs, who dominate the domestic manufacturing segment. to avail of the benefits are limited.
- The skilling landscape remains suboptimal for supporting the massive reskilling and skilling that is necessary to ensure the employability of the workforce in the EV ecosystem.

The policy landscape of the automobile sector in India is multifaceted, encompassing various policies and plans, and initiatives promulgated at the national and state levels with a focus on promoting the growth of the sector and also supporting innovation and sustainability.

The policy evaluation has been undertaken from the perspective of the sector's readiness to transition from ICE vehicles to EVs while maintaining its economic competitiveness, growth ambition, and job creation potential. The evaluation focuses on key national-level policies, plans, and schemes in this regard, and also evaluates policy measures of the state government with a focus on three states, Maharashtra, Tamil Nadu and Haryana, which not only have a large consumer base but are also home to the major auto-manufacturing clusters.

3.1 National-level policies and plan

The review of the national-level policies and plans related to the transition can be broadly placed under four categories:

- Policies, plans and schemes focused on the overall growth of the automobile sector, making India an auto manufacturing and export hub;
- Policies, plans and schemes focused on the green transition of the sector, with a specific focus on electric mobility (EV);
- Policies and schemes related to skilling and workforce development for the sector; and,
- Policies to support the MSMEs (as ACMs are dominated by such enterprises).

A. Policy for the overall growth of the sector

The Automotive Mission Plan (AMP), first launched by the Ministry of Heavy Industries (MHI) in 2006 is one of the key strategic plans by the Government of India (GoI) to boost the growth of the sector, both for domestic market and exports.

The plan first proposed for 2006-2016, put a target of doubling the sector's contribution to the country's GDP to 10% by 2016 ($145 billion), by fostering both domestic market and exports.[1]

In 2016, the plan was revamped and the next phase for the period of 2016-2026 was rolled out. The current plan outlines long-term objectives and strategies for the development of the automotive industry.[2] Overall, the plan prioritises four key aspects for the sector:

i. Making the Indian automotive industry "among the top three of the world in engineering, manufacture, and export of vehicles and auto components", making the sector "efficient and environment-friendly" and ensuring "affordable mobility of people and transportation of goods in India comparable with global standards".

ii. Make the Indian automotive industry a significant contributor to the "Skill India" programme and make it one of the largest job-creating engines in the Indian economy.

iii. Promote safe, efficient, and comfortable mobility for every person in the country, with an eye on environmental protection and affordability through both public and personal transport options.

iv. Increase net exports of the Indian automotive industry. Vehicles and auto components has the potential to scale up exports to the extent of 35-40% of its overall output over the next ten years and become one of the major automotive export hubs of the world.

B. Policy for the green transition of the sector

Considering the imperatives of a green energy transition and the opportunities for green growth, the GoI has proposed a combination of plans and schemes/programmes to support the growth of EVs, boost domestic manufacturing and create employment opportunities. The National Electric Mobility Mission Plan (NEMMP) 2020, and schemes and programmes under it, remain significant in this regard.

i. National Electric Mobility Mission Plan (NEMMP): Along with promoting the overall growth of the automobile sector, the Government of India (GoI) over the last decade has developed targeted policy measures to support the growth of electric mobility, reduce the dependence on fossil fuel, and improve environmental sustainability. One of the most important exercises was proposing the NEMMP, which was developed by a process of wide stakeholder consultation. The plan set an ambitious target to achieve 6-7 million sales of hybrid and electric vehicles year on year from 2020 onwards.

To support the penetrations of EVs, the plan underscored five key aspects;[3]

- The need for developing schemes/programmes for generating demand;
- Incentivizing domestic manufacturing of EVs and related components;
- Supporting EV infrastructure;
- Promoting research and development (R&D); and,
- Creation of job and employment opportunities in the manufacturing segment and new related services.

In the subsequent years, several important schemes have been developed under the NEMMP to provide fiscal incentives for the adoption of EVs, development of capital assets (such as electric buses for public mobility, and charging infrastructure), and to boost domestic manufacturing of automobile and automobile components, enhance government revenue and create jobs. The most significant ones include the Faster Adoption and Manufacturing of Hybrid and EV scheme (FAME I and II), the Production Linked Incentive (PLI) scheme for Automobile and Auto components (PLI-Auto), and the PLI scheme for rolling out the National Programme on Advanced Chemistry Cell (ACC) Battery Storage (PLI- ACC).

ii. Faster Adoption & Manufacturing of Hybrid and EV (FAME): The FAME scheme was initially launched in 2015 (Phase I) for four years from April 1, 2015, to March 31, 2019. Phase I of the scheme with a budget outlay of ₹8.95 billion[4] provided government incentives, including generating consumer demand for the adoption of EVs, deployment of electric and hybrid buses and development of charging stations across India. Besides, funds were provided to eminent institutes, such as the Automotive Research Association of

India (ARAI), Indian Institute of Technology (IIT) Madras, IIT Kanpur, Non-Ferrous Material Technology Development Centre (NFTDC), Aligarh Muslim University (AMU) among others, for various technology development projects, setting up of a 'centre of excellence' for advanced research in electrified transportation, battery engineering, etc.[5]

Table 3.1: Implementation of FAME I

Component	Number	Funds disbursed (₹ billion)
Adoption of EVs (demand incentives)	280,000	3.59
Deployment of electric and hybrid buses	425	2.8
Charging stations	520	0.43
R&D		1.5
Total		**8.32**

Source: Ministry of Heavy Industries, Rajya Sabha Questions dated December 8, 2023

The second phase of the scheme (FAME Phase II), which commenced in April 2019 remains effective until march 31, 2024.[6] Phase II of the scheme was initially notified for three years with a total outlay of ₹100 billion, including demand incentives (about 86% of the outlay) for the wider adoption of hybrid and electric vehicles, development of charging infrastructure, and other administrative and associated costs.[7] Recently in february 2024, the MHI increased the budget for FAME II to ₹115 billion.[8]

Table 3.2: Outlay for Implementation of FAME II

Components	Budget outlay (₹ billion)
Subsidies (demand incentives) for the adoption of EVs	**70.48**
• Subsidies for two-wheeler	53.11
• Subsidies for three-wheeler	9.87
• Subsidies for four-wheeler	7.5
Grants for the creation of capital assets	**40.48**
Electric buses (e-buses)	32.09
EV charging stations	8.39
Others (administrative, outreach, etc.)	4.04
Total	**115**

Source: Ministry of Heavy Industries and Public Enterprises, february 2024

As per information from december 2023, about ₹52.5 billion subsidy has been given to EV manufacturers on the sale of over 1.16 million EVs. The GoI has also sanctioned the deployment of 6,862 e-buses and 7,580 EV charging stations (7,432 stations to three oil marketing companies and 148 to other entities).[9]

iii. Phased Manufacturing Programme: The Phased Manufacturing Programme (PMP) has been introduced under Phase-II of the FAME scheme. The key objective of the scheme is to indigenise production, increase domestic value addition and thereby "increasing the domestic value addition and creating employment opportunities".[10]

The scheme proposes a graded custom duty structure for vehicle parts and components. The 2019 notification under which the programme was promulgated outlines basic customs duty (BCD) to be levied on various types of vehicles and components coming into the country, in several cases doubling the BCD as compared to the duty effective during that time. For example, the BCD for Lithium-ion cells have been doubled from 5% to 10% and that of the battery packs from 5% to 15%. Similarly, the BCD on parts used for the manufacture of EVs have been increased to 15%.

iv. Production Linked Incentive: The PLI Scheme of the GoI is aimed at boosting domestic manufacturing of particularly high-value automotive technology and related components. These are two PLIs that have been launched until now for the auto sector.

These include the PLI for the rollout of the National Programme on Advanced Chemistry Cell (ACC) Battery Storage as notified in june 2021,[11] and the PLI for the automobile and auto components industry, as notified in september 2021.[12]

The PLI for the ACC Battery Storage envisages setting up a cumulative manufacturing capacity of 50 GWh for ACCs and an additional cumulative capacity of 5 GWh for niche ACC Technologies by 2028-2029. For this, a total of ₹181 billion has been earmarked.

Through this scheme, the GoI intends to optimally incentivize potential investors, both domestic and overseas, to set up advanced storage technologies with emphasis on maximum value addition. Some of the key conditions and targets under the scheme are:

- The selected beneficiary firm will have to commit to setting up a minimum of 5 GWh of ACCs manufacturing facility (the total annual cash subsidy to be disbursed by the government will be capped at 20 GWh per beneficiary firm). The manufacturing facility as proposed by the beneficiary firm would have to be commissioned within a period of 2 years.
- For niche ACC technologies, the minimum threshold capacity is 500 MWh.
- The beneficiary has to ensure achieving a domestic value addition of at least 25% within two years (at the mother unit level). By five years, the domestic value addition should rise to 60% either at the mother unit (in case of an integrated unit), or at the project level (in case of hub and spoke structure).

The subsidy payable to the beneficiary firm (every quarter) under the scheme is sale-linked. For example, the subsidy amount will be determined as

Applicable subsidy amount/kWh x Percentage of value addition achieved during the period x Actual sale of ACCs (in KWh)

Overall, the subsidy provided will be capped at 20% of the sale price (net of GST).

The PLI scheme for the automobile and auto components industry has been promulgated initially for a period of five years with an outlay of ₹25,938 crores (effective from FY2022-23 to FY2026-27). The overall objective of the scheme is to boost domestic manufacturing of advanced automotive technology (AAT) products and attract investments in the automotive manufacturing value chain.

The PLI scheme seeks to benefit makers of advanced automotive technologies or auto components. Like the PLI for ACCs, the subsidy payable to the beneficiary firm under the scheme is sale value linked.

Table 3.3: Targets and objectives of the PLI-auto scheme

Scheme segments	Target segment	Objective	Incentive type
Champion OEM Incentive Scheme	Applicable on battery electric vehicles and hydrogen fuel cell vehicles of all segments two-wheelers, three-wheelers, passenger vehicles, commercial vehicles, tractors, etc.	Address the cost disabilities related to AAT vehicles faced by OEMs	Sale value linked; Applicants will be entitled to receive growth incentives (% benefit) on Determined Sales Value (DSV). The threshold DSV for the first year is ₹125 crore in respect of all companies.
Component Champion Incentive Scheme	ACMs or its group company(ies), OEMs or its group company(ies) and new non-automotive investor company or its group company(ies).	Identify and incentivize auto component champions that can achieve global scale of operations and become 'automotive champions' for the auto-component manufacturing sector related to AAT.	Sale value linked; Applicants will be entitled to receive growth incentives (% benefit) on DSV. The threshold DSV for the first year is ₹25 crore in respect of all companies.

Source: Ministry of Heavy Industries and Public Enterprises, september, 2021

v. Other fiscal incentives: Besides the key policy aspects, the GoI has taken some important measures to incentivize the adoption of EVs.

The Ministry of Finance has proposed tax rebates for the adoption and use of EVs under the Goods and Services Tax (GST) Act, 2017 and the personal income tax. The following have been enforced accordingly:

- The GST on EVs reduced from 12% to 5%, and on chargers/ charging stations for EVs from 18% to 5% with effect from August 2019.[13]
- The Income Tax Act specifies a 'deduction' from the gross total income of an individual in respect of the interest payable on the loan taken from any financial institution for purchasing an EV if the loan has been sanctioned by the financial institution during the period from april 1, 2019, to march 31, 2023.[14]

The MoRTH had also announced fiscal incentives for battery-operated vehicles. It has been notified that such vehicles will be given green license plates and will be exempted from permit requirements. The Ministry also issued a notification advising states to waive road tax on EVs, which also has implications for reducing the initial cost of EVs.[15]

C. Policy for skilling and workforce development

Skilling and development of the future workforce is a key issue for the automobile sector considering its significance for India's manufacturing sector and the projected workforce requirement by the industry.[16] The sector is estimated to employ about 30.7 million people considering direct (13.7%) and indirect employment (86.3%).

Concerning policies supporting skill development for the automobile sector, the Ministry of Skill Development and Entrepreneurship (MSDE) is the nodal ministry overlooking most of the important schemes related to skilling and workforce development. Two schemes are most significant in this regard- the Pradhan Mantri Kaushal Vikas Yojana (PMKVY), and the National Apprenticeship Promotion Scheme (NAPS).

The PMKVY was launched in 2015 and is implemented by the National Skill Development Corporation (NSDC). Under this scheme typically short-term trainings are offered. Currently, about 13% of the training centres established under the PMKVY offer training courses related to the automobile sector.

Table 3.4: Auto sector-related courses under PMKVY

Parameters	Number
Total centres[17]	2,640
Total number of centres offering training on automobile-related job roles (40 job roles)	523 (training capacity of approximately 54,000 individuals)

Source: PMKVY dashboard.[18]

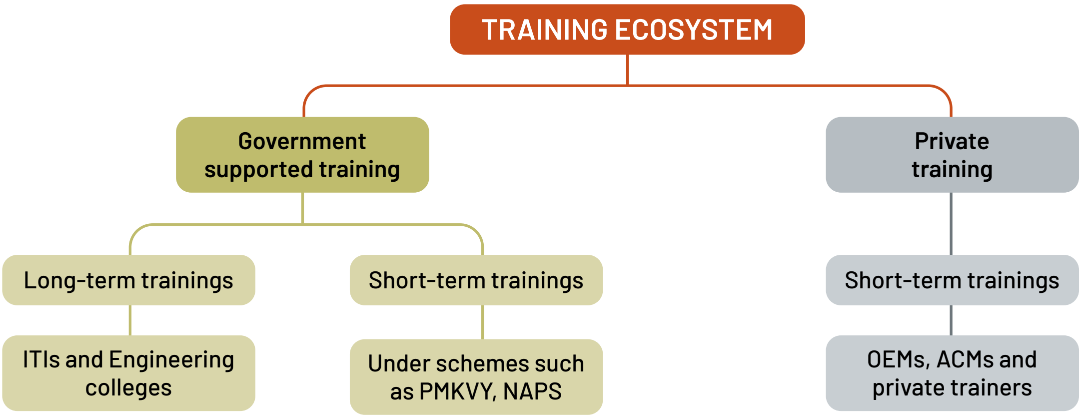
Another important component of the PMKVY is Recognition of Prior Learning (RPL), which is a form of a bridge course. Under this, individuals with prior learning experience or skills are assessed and certified. Implementing agencies for this component are the Sector Skill Councils (SSCs) or any other agencies designated by MSDE/NSDC.

The NAPS was launched in 2016, and is implemented by NSDC and the Directorate General of Training (DGT). Under the scheme, there are 34 apprenticeship courses, of which eight are related to EVs and electronics.[19] In the last five years (since 2018), 0.6 million apprentices have been trained under NAPS for the automobile sector.[20] The scheme also incentivizes enterprises to train their employees by providing 25% of the stipend that the apprentice receives from the company (with a cap of ₹1,500 per individual).

Apart from short-term training supported through the above-mentioned schemes, long-term training concerning the automobile sector is offered through government institutes like ITIs, IITs, NITs, and other government and private engineering universities and colleges having courses/curricula related to the job roles of the auto sector. Besides these, enterprise-based training (especially on-the-job training) is offered directly by OEMs and ACMs.

There are also several skilling programmes implemented by the ASDC (not under government schemes) for the automobile sector. However, most of these programmes are yet not specifically designed to cater to the needs of the EV industry.

Figure 3.1: Skilling ecosystem



Source: iFOREST analysis

D. Policies for support of the MSMEs

In the automobile sector, the ACMs are dominated by MSMEs. Therefore, policies targeted at the MSMEs hold high significance for the holistic growth of the automobile sector.

The GoI have enacted the MSME Act in 2006 to facilitate the promotion and development of MSMEs and increasing their competitiveness.[21] Towards this purpose the government needs to support the development of skills of employees, support technological upgradation, assist in cluster development, provide infrastructure and marketing support among others. section 9 of the act stipulates that the *"Central Government may, from time to time, for the purposes of facilitating the promotion and development and enhancing the competitiveness of micro, small and medium enterprises, particularly of the micro and small enterprises, by way of development of skill in the employees, management and entrepreneurs, provisioning for technological upgradation marketing assistance or infrastructure facilities and cluster development of such enterprises with a view to strengthening backward and forward linkages, specify, by notification, such programmes, guidelines or instructions, as it may deem fit.*[22]

Over the past years the government has developed a number of schemes to support the growth of MSMEs and workforce development. Some of the key ones include, Technology Upgradation Scheme for MSMEs. Credit Guarantee Fund Scheme, Cluster Development Programmes, etc.

MAJOR MSME SCHEMES RELEVANT TO THE AUTOMOBILE SECTOR

Credit Guarantee Scheme for Micro and Small Enterprises (CGTMSE): The scheme aims to support first-generation entrepreneurs by providing credit guarantees for collateral-free loans to micro and small enterprises, particularly those lacking collateral. Guarantee coverage varies based on factors such as enterprise size, women's ownership, location, etc., to foster entrepreneurship and financial inclusion. The Ministry of Micro, Small and Medium Enterprises and Small Industries Development Bank of India (SIDBI) has established the Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE) to implement the scheme.

The Micro and Small Enterprises Cluster Development Programme (MSE-CDP) aims to enhance the growth of MSMEs by addressing common challenges like technology enhancement, skill improvement, and market access. It focuses on creating or upgrading infrastructural facilities in industrial areas or clusters, including promoting green and sustainable manufacturing technologies within these clusters.

MSME Champions Scheme: The MSME Champions Scheme is a comprehensive initiative aimed at promoting competitiveness and innovation among MSMEs. It focuses on enhancing productivity, reducing wastage, and fostering global competitiveness.

Prime Minister's Employment Generation Programme (PMEGP): This scheme aims to provide financial assistance for setting up self-employment ventures and boost employment opportunities. It offers credit-linked subsidies for new micro-enterprises in the non-farm sector, with margin money subsidies ranging from 15% to 35% of the project cost, depending on the sector and beneficiary category. Beneficiaries contribute 10% or 5% of the project cost and banks sanction the remaining project cost.

The Pradhan Mantri Mudra Yojana: This scheme aims to empower MSMEs by facilitating access to affordable credit, enabling them to establish and expand their businesses. By supporting micro-businesses with essential financial resources, the scheme aims to foster entrepreneurship and growth of MSMEs.

Source: Ministry of Micro, Small and Medium Enterprises, Government of India. (2022). Schemes for MSMEs.

3.2 State-level policies

Various state governments in the past three years have developed policies to support the transition from ICE to EVs, while increasing opportunities for revenue generation for the state and enhancing employment opportunities. The measures also follow the FAME II notification (2019), which emphasised that the Centre's initiatives to encourage e-mobility require additional backing from state governments.

Presently 30 states and union territories have a notified EV Policy.[23] The key components of the state policies are EV targets, demand-side incentives for consumers, supply-side incentives to support the production, manufacturing, and deployment of EVs, charging infrastructure mandates, and ecosystem development which consider aspects such as job creation, incubation and research and development (R&D).

An in-depth review of the state EV policies of Maharashtra, Tamil Nadu and Haryana, the three auto hubs of India, shows the following key trends:

a. **Setting targets for EV penetration and supporting infrastructure:** The states have set targets for EV penetration, electrification of buses and government vehicles, and developing charging infrastructure, among others.

b. **Incentives for EV manufacturing:** The states offer incentives, subsidies, and tax breaks to attract EV manufacturers and support the establishment of EV manufacturing facilities, aligned with the GoIs objectives under the PLI schemes for auto and ACC batteries.

c. **Creating ease of doing business ecosystem:** The policies also are focused on ease of doing business for the manufacturers. For example, the Tamil Nadu policy emphasizes subsidies on the cost of land procurement in government industrial estates (subsidy percentage varies between districts, with a minimum of 10% to 50%). Also, tax holidays are provided for the purchase/lease of land obtained from government agencies (100% exemption on stamp duty), on electricity (100% exemption on electricity tax for a period of five years on power purchased from the state generation company, or generated and consumed from captive sources). Besides single window portals have been created to streamline the procurement of necessary clearances and permits for EV charging station operators such as planning permits, building permits, etc., electricity connection, and trade licenses, and no objection certificates (NOC), for compliance.

d. **Incentives for EV adoption:** The policies also outline fiscal incentives (such as tax and registration exemptions) for enabling EV adoption. For example, the Maharashtra EV policy covers most vehicle categories for basic incentives. Besides, the state also has noted incentives for vehicle scrappage and assured buyback. The Tamil Nadu policy on the other hand does not provide any direct incentives on the 2W, 3W, or the 4W segment. Instead, it focuses on promoting e-cycles providing direct incentives for the same.

e. **Supporting public transport:** Some of the state policies also incentivise the deployment of e-buses. The Maharashtra policy has particularly laid importance on this towards achieving the target of transitioning 15% of the existing fleet of Maharashtra State Road Transport Corporation's (MSRTC) to electric. The incentive is set at 10% of the vehicle cost, with an incentive cap of ₹2 million per vehicle. The state policy also encourages financial institutions and banks to offer preferential interest rates for e-autos, goods carriers, and taxis.

f. **Workforce development and employment:** One of the key aspects of the state policies is supporting workforce development as the transition from ICE to EV happens. For example, the Tamil Naadu policy outlines incentives for auto companies to upskill their workforce. Automotive companies shall be eligible for an up-skilling allowance for up to 10% of their existing workforce working on the EV production line. The "transition support" can be availed in the form of a training subsidy of ₹4,000 per worker per month for 6 months for residents of Tamil Nadu. For women and transgender employees, persons with disabilities, and persons from SC/ST communities, the training subsidy is ₹6,000.

The Maharashtra policy has emphasized workforce development in coordination with institutions and OEMs. The policy notes that the state shall revise existing courses and/or create new courses on the EV ecosystem to be offered by the state Industrial Training Institutes. The government in partnership with relevant/interested OEMs and service providers, shall also develop skill enhancement centres for delivering vocational courses on the EV ecosystem. The skill enhancement centres will aim to train the ICE mechanics/ workforce in repairing and servicing EVs and charging stations.

The Haryana policy focuses on employment subsidy to generate and retain local employment. The policy specifies that the units shall mandatorily employ at least 75% of Haryana domicile workforce, to be able to receive the employment incentive.

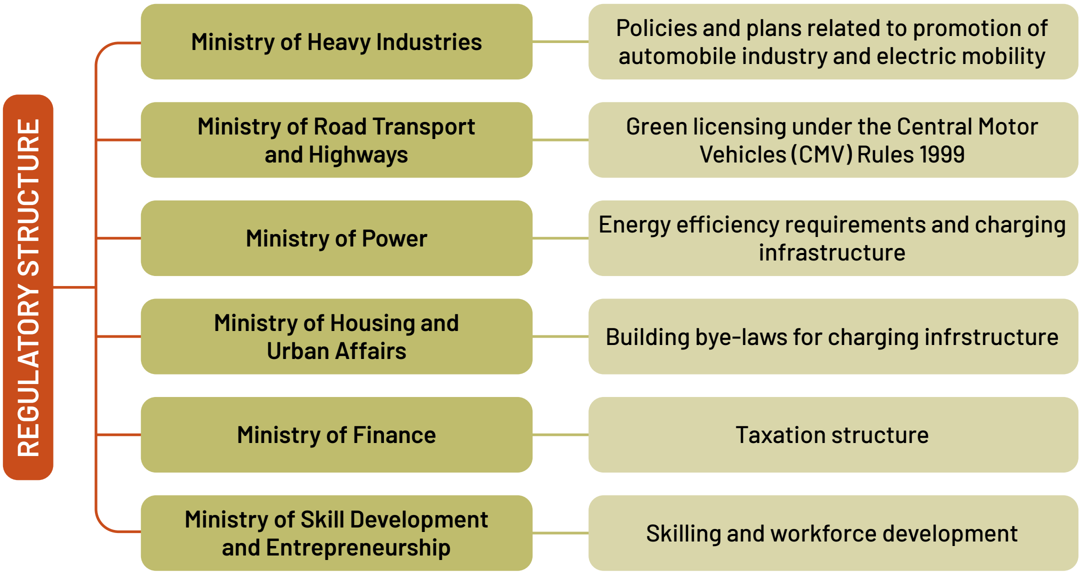
3.3 Overall observations

A review of the policy landscape at the national and state levels suggests that while several important policy measures have been developed by the GoI in recent years, certain outstanding concerns need to be considered to ensure comprehensive measures for a just transition of the sector. This is particularly important considering India's growth ambition related to the sector, and the opportunity for the country to become a global leader in the green auto industry.

i. **There is no consistent national-level policy to guide a green and inclusive transition in the automobile sector:** The policy environment guiding the transition to EVs remains fragmented. There are various ministries and departments involved in developing policy measures to support some of the central schemes currently guiding the EV transition.

For example, at the national level, the MHI remains responsible for developing policies, plans and schemes related to the promotion of the automobile industry, including e-mobility. Besides, the Ministry of Road Transport and Highways (MoRTH), Ministry of Housing and Urban Affairs (MOHUA), Ministry of Power (MoP) and the Ministry of Finance (MoF), have developed a set of supporting measures over the years to support necessary infrastructure development, promote the use of non-conventional fuels and electrification of mobility, and provide necessary fiscal incentives to support the growth of the sector from both supply and demand side. The MSDE also remains significant for implementing skilling and workforce development programmes in partnership with various implementation agencies. At the state level, the state industry and commerce departments are the nodal authorities for the EV policy.

Figure 3.2: Ministries involved in the formulation of policy measures for green transition in the automobile sector



Source: iFOREST analysis

Such fragmentation in policies leads to sub-optimal outcomes. The government, therefore, needs to define targets and plans which are long term, consistent and coherent across ministries.

The absence of a comprehensive and stable policy has also been highlighted by the department-related Parliamentary Standing Committee (PSC) on Industry, in their report on 'Promotion of Electric Vehicles in the Country', tabled in the Rajya Sabha (Upper House) in december 2023. The committee recommends that the "Government should strive towards the formulation of a consistent and stable national policy on electric mobility so that a propitious environment is created for the EV industry to promote a sustainable and clean transportation system in the country".[24]

ii. **Major focus on incentives for demand generation and adoption for personal vehicle ownership under national policies can undermine sustainable urban development:** The policy measures are primarily focused on generating demand for personal EVs through demand-side incentives. For example, over 61% of the revised budget outlay under FAME II, is in the form of subsidy for the adoption of two, three and four-wheelers. The incentives under the PLI schemes are also linked to the sell value, which, therefore, indirectly relates to generating personal demand.

While generating demand for EVs is important, a focus on personal vehicle ownership will be challenging from the overall sustainability perspective in urban areas. Without simultaneous (and increased) promotion of green and efficient public transport, and related infrastructure and networks, a linear growth in private ownership of EVs risks undermining overall urban sustainability.

iii. **The national policies are focused on high-value manufacturing:** The PLI schemes are designed to attract investments and increase domestic manufacturing of AAT, and high-value products. While this is important to reduce India's import dependence of high tech and high-value products, however, considering that the existing domestic manufacturing segment is dominated by MSMEs, their ability to avail of these incentives and improve/upgrade their products is limited. While they can benefit through a trickle-down effect, their direct interests may not be safeguarded. However, from a transition perspective the medium, small and micro enterprises involved in auto component manufacturing remain most vulnerable.

iv. **Limited focus on workforce development and transition:** There is a limited focus on workforce development and transition of the existing workforce under the national schemes. The existing skilling programmes are not designed to support the large-scale transition of the workforce that is necessary to align with the EV transition. The existing measures under PMKVY and the NAPS remain suboptimal.

While at the state level, there is a recognition of workforce development and retention of locale employment, a far more comprehensive policy is required at the national level, in coordination and consultation with state governments to support workforce transition and future workforce development.

v. **Limited advanced technology and research base:** While various schemes are aimed at enabling EV adoption and boosting domestic manufacturing, there is a dearth of advanced research and technology base both at the national and state levels. As per the NITI Aayog, this "will impact the global competitiveness of the Indian EV industry"[25] unless necessary measures are adopted.

04

Towards a Sustainable, Just, and Inclusive Future for India's Automobile Sector

KEY FINDINGS

- A comprehensive 'Just Transition Policy Framework for the Automobile Sector' will be required to support a holistic transition from ICE vehicles to EVs.
- The advancement of technology and the development of human resources must progress together to ensure the availability of skilled personnel and leverage technological capabilities.
- Boosting green manufacturing practices for OEMs and ACMs by providing fiscal and non-fiscal incentives, and technological support will be crucial to support green growth and boost green job opportunities.
- Massive investments in skilling and reskilling by the government and the industries, and designing skilling programmes tailored to the demands of the EV ecosystem will be essential for workforce transition and developing a future-ready workforce.
- Mandating the development of a Workforce Transition Plan by OEMs is essential to strengthen enterprise-level measures and complement government policies.
- A dedicated transition fund needs to be established to support the MSMEs, including their workforce, in transitioning from ICE vehicles to EVs.

4.1 Just transition vision

Transitioning to clean mobility, such as from ICE to EV and other sustainable transportation solutions, offers numerous environmental benefits, including reduced GHG emissions, improved air quality, and decreased reliance on fossil fuels. However, like any major shift, it will also result in disruptions across the value chain of the automobile sector including the workforce. At the same time, the transition will need to be environmentally sustainable considering the energy and material requirements involved in their production, use, and disposal.

For India's automobile sector, therefore, the need of the hour is to seize the opportunities of the transformation backed by technology and innovation, while ensuring workers' resilience and security, supporting sustainable choices by citizens that are affordable and accessible, and reducing the lifecycle impact of EVs to realise a green and just transition of the automobile sector.

Considering this, the just transition vision of the automobile sector should be based on four pillars:

i. Technology and skilling;

ii. Vibrant green manufacturing;

iii. Sustainable mobility choices; and

iv. Green energy and material circularity

Each of these pillars is outcome-oriented and designed to guide the development of practical and holistic policies, plans, and investments.

Technology and skilling: The first pillar, technology and skilling, is perhaps the most critical pillar of a just transition in the automotive sector. The advancement of technology and the development of human resources must progress together to ensure the availability of skilled personnel to fully leverage technological capabilities. Simultaneously, technology needs to be designed and implemented in ways that reduce job displacement and improve job prospects. Consequently, the planning of skill-enhancement programmes and investment in education, including vocational training, should be executed so that the growth in human resources is in sync with technological advancements and evolving demands. Similarly, research and development (R&D) and policies governing the transition to new technologies should consider the implications for employment and worker employability.

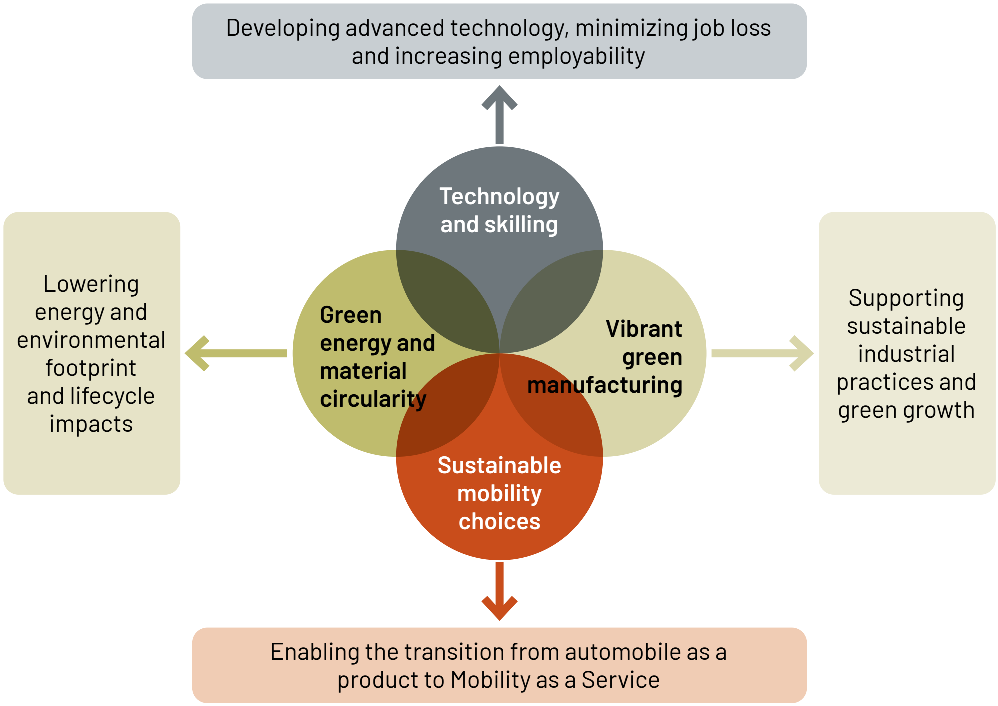
Vibrant green manufacturing: The second pillar, vibrant green manufacturing, is positioned to make India a hub of green automobile manufacturing. This pillar will promote green manufacturing practices by both OEMs and ACMs and support the green growth agenda.

Sustainable mobility choices: The third pillar, sustainable mobility choices, will enable the transition from automobile as a product to Mobility as a Service (MaaS). It will promote sustainable urban mobility, reduce congestion and pollution, and support a diversification of income opportunities around clean mobility..

Green energy and material circularity: The fourth pillar, green energy and material circularity, should reduce the life cycle impact of EVs, from energy and material use, to end-of-life material management.

Collectively, these pillars wil aid the progress toward a sustainable, economically vibrant, just, and inclusive automobile future.

Figure 4.1: Pillars of just transition of the automobile sector



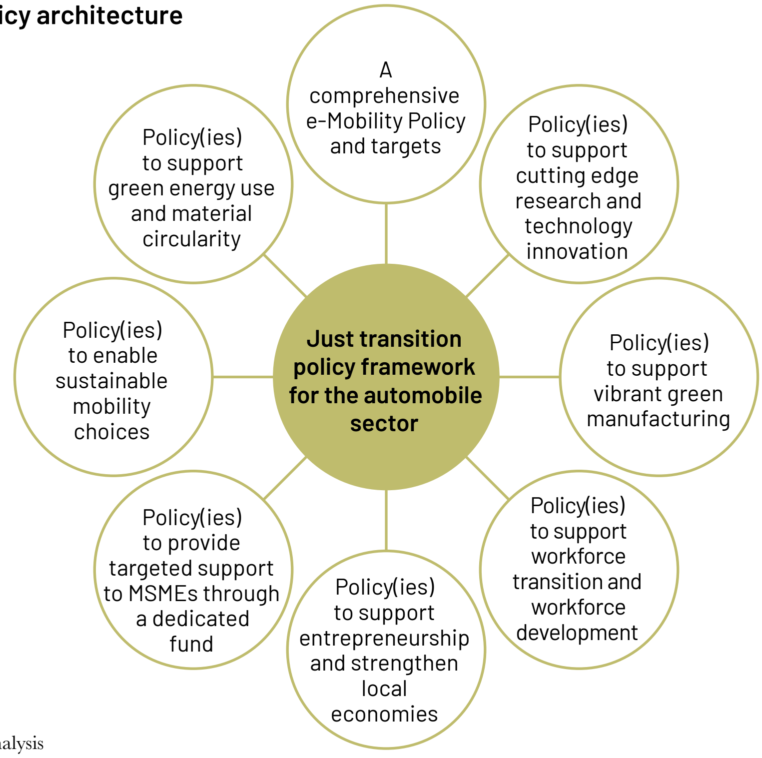
Source: iFOREST analysis

4.2 Policy intervention

India is already riding the tides of the EV transition. The GoI has developed and implemented policies, plans, and schemes over the past years to increase the adoption of EVs, support infrastructure development, and boost domestic manufacturing. Simultaneously, various state governments have also proposed policies with the above-mentioned objections, along with stipulations to boost the state's GDP, generate local employment, and support a clean public transport fleet.

However, the review of the current policy landscape shows that while such measures are important, the policy architecture to support a sustainable, just and inclusive transition of the automobile sector needs to be more comprehensive and integrated. Therefore, going ahead, developing a comprehensive policy will be required to support a transition of the sector. The policy should be aligned with the country's vision of strengthening opportunities for green growth and, boosting green jobs, fostering environmental stewardship, and building a clean mobility future.

Figure 4.2: Policy architecture



Source: iFOREST analysis

a. **A comprehensive e-mobility policy:** A consistent national-level policy and target(s) are required to guide a green and inclusive transition in the automobile sector. The central government, therefore, needs to define targets and plans for EVs that are long-term, consistent, and coherent across ministries. A comprehensive national policy and target(s) will also help to guide coordinated state action and help to achieve comprehensive outcomes.

b. **Policy(ies) to support cutting-edge research and technology innovation:** India should aim to leverage its expertise in engineering and innovation to become a global leader in the development and adoption of cutting-edge automotive technologies and position itself as a hub for automotive innovation. The national policy should support research and development, and foster collaboration between research institutions, industry, academia, and the government.

Also, standardisation of EV technology, especially for battery and charging parts and components, is extremely important to drive down the costs of the vehicle as well as of the charging infrastructure. The GoI should notify standards that align with the global best practices to drive down costs and enable exports.

c. **Policy(ies) to support vibrant green manufacturing:** The transition of the automobile sector should promote a vibrant and competitive green manufacturing ecosystem to cater to domestic demand and capture the export market. Boosting green manufacturing will also help to realize the target of reducing the emission intensity of the country's GDP by 45% by 2030, as the auto manufacturing sector remains a major contributor to the country's GDP.

Policy(ies) to support green manufacturing should focus both on OEMs and ACMs. For OEMs, the policy can support the following:

- Offer financial and non-financial incentives for OEMs to adopt green manufacturing practices, such as utilizing RE, investing in energy-efficient equipment, implementing green procurement measures, material reuse, etc.
- Promote R&D investments to innovate on green manufacturing practices.
- Establish guidelines and standards for green manufacturing.
- Promote industry benchmarking and reporting on environmental performance metrics.

For ACMs, the following are some of the key aspects that the policy measures should focus on:

- Establish specific guidelines and standards for green manufacturing, tailored to the scale and capabilities of ACMs.
- Provide technical assistance to ACMs belonging to the MSME category to adopt green manufacturing practices.
- Offer financial incentives such as grants, subsidies, and tax incentives to MSMEs for adopting green manufacturing technologies and practices.
- Ensure access to credit and risk capital to support investments in green manufacturing.
- Facilitate partnerships between ACMs, OEMs, technical experts, and research institutions to transfer knowledge and technologies.

The Centre and the State Governments need to align their industrial policies with EV transition-related policies to support green manufacturing.

d. **Policy(ies) to support workforce transition and workforce development:** A central issue of just transition of the automobile sector is the transition of the workforce currently engaged in the conventional auto sector. This is essential to ensure their adaptability and secure their employment in the EV value chain. Besides, it is also important to prepare the future workforce for the evolving industry requirements.

The assessment of the workforce engaged in ACMs, particularly in MSMEs shows that many of them are not transition-ready. Simultaneously, analysis of the skill ecosystem shows that while the GoI has a major emphasis on investments in skilling programmes, there exists a significant gap between the existing progarmmes and the job roles and the skills required to cater to the EV transition. At the enterprise level, workforce skilling measures are largely restricted to the OEMs and large enterprises.

Therefore, a comprehensive workforce transition policy in the automobile sector will be required to support the existing workforce that will be impacted by the transition and prepare a future-ready workforce. The workforce transition policy needs to address interventions required by the government, as well as the enterprises.

As part of the government measures, the following are some of the key interventions that need to be considered:

- Establish a Skills Taskforce at the state level, consisting of members of OEMs, ACMs, skill councils, training institutes, and research institutions, to generate data on workforce profile, including their education and skills levels, to assess education and skill gaps to enable the design of training, academic and vocational progarmmes.
- Foster engagement between the implementation agencies of government training programmes, such as NSDC and ASDC, and the training institutes, such as the ITIs or Skill Sector Councils, with the industry for designing curriculum, evaluating training outcomes, and providing certification, among others.
- Redesign the short and long-term training programmes considering the job roles and educational and technical requirements for the EV value chain. The training curriculum should include modules on advanced EV technologies, battery management systems, and sustainable manufacturing practices.
- Foster collaboration between the training institutes and educational institutions to design credit-based, continuous learning-oriented courses.
- Engage technology partners to design on-demand 'Phygital' learning courses for up-skilling existing workforce.
- Promote on-the-job quick capsule training while ensuring no reduction in wages for workers participating in such training.
- Support standardized certification criteria for EV-related skills.
- A key focus of workforce transition should be women. Equal employment opportunities should be ensured for women by adopting measures to improve their access to foundational skills and skilling programmes, and increase employability.

Besides, interventions on skilling, one of the necessary policy interventions will be mandating the development of a 'workforce transition plan' by the OEMs *(see box: Workforce Transition Plan)*.

WORKFORCE TRANSITION PLAN

Mandating the development of workforce transition plans by the OEMs can be an effective policy instrument for workforce transition at the enterprise level, and complement government policies and transition measures.

The plan for workforce transition should be output-oriented, and include information regarding (but not limited to) the following aspects):

- The number of workers to be impacted by the transition at various levels, including their job roles.
- Assess the need for transition support necessary, including reskilling/skilling, temporary assistance, mobility assistance, etc.
- Outline a plan for providing transition support, including support on reskilling and skilling, to employees and workers of the enterprise.
- Outline a reskilling/skilling plan for ACM workers.
- Identify the scope of engagement with governments, institutions, or other skilling agencies, for support to workers, where OEMs will not be directly engaged.
- Outline a monitoring and evaluation strategy with key performance indicators (KPIs) to measure the success of the transition plan and monitor progress and success of implementation.

Overall, innovative and cooperative strategies will need to be designed to support workforce transition and workforce development for various categories of workers, including women, aligned with the technological changes and innovation in the automobile sector.

e. **Policy(ies) to support entrepreneurship and strengthen and secure local economies:** The transition of the automobile sector is not a transition in isolation and will influence the local economy. As on-ground survey by iFOREST in major auto clusters show, there is a very significant income dependence along the value chain, such as workers involved in repair and maintenance. A large share of them are also informal workers.

To reduce the vulnerability of workers along the value chain, specific policy measures can be developed. A key one in this regard will be to mandate a 'Right to Repair and Servicing' policy to enable EV manufacturers to involve local service centers in repair and servicing and retain employment.

Besides, such specific measures, overall, the policies for the transition of the auto sector should be aligned with plans to diversify and strengthen regional industrial ecosystems, support broader demands of green job creation, and maintain economic and social cohesion. For this, regional impact assessments can be undertaken to develop cohesive investments and intervention measures.

f. **Policy(ies) to provide targeted support to MSMEs through a dedicated fund:** The automobile sector in India, especially the manufacturing segment is dominated by MSMEs who have limited resources, technology, and the capability to adapt to the evolving needs of the EV sector, diversify their businesses, and provide reskilling support for workers. Establishing a funding instrument to support enterprises and workers that are particularly vulnerable can be hugely beneficial to minimise and mitigate any adverse impact of the EV on such enterprises and the workforce.

The Central Government may establish a dedicated transition fund to support the MSMEs, including their workforce to facilitate a just and inclusive transition of the automobile sector. Towards this, the Government can issue necessary notification(s) and guidelines under Section 9 of the MSME Act, 2006.[1] The fund can be used for the following key purposes:

- Providing transition support for workers, especially skilling and reskilling, related to the job roles in the EV sector.

- Providing grants, low-interest loans, or subsidies to MSMEs for upgrading their manufacturing processes, adopting new technologies, and supporting the reorientation of enterprises involved in ICE component manufacturing towards EV components.
- Providing assistance for accessing new markets to diversify their customer base.

g. **Policy(ies) to enable sustainable mobility choices:** A clean mobility future should be intricately related to sustainable mobility choices and lifestyle practices. The Prime Minister of India in his vision for clean mobility has emphasised "7Cs", two central tenets of which are "common" and "congestion-free".[2]

   Essentially, as the EV transition accelerates, it should be balanced by considerations of the sustainability of our urban spaces, and support a shift in the idea of mobility.

   In the sphere of transportation policy and urban policy, the idea of mobility as a service (MaaS) is gaining momentum.[3] MaaS aims to shift from traditional car ownership models towards shared models of mobility, where convenience and comfort can be ensured. The uptake of MaaS could bring about considerable environmental and societal benefits,[4] such as lowering individual carbon footprint, reducing congestion, and boosting service sector employment opportunities in the clean mobility ecosystem.

h. **Policy(ies) to support green energy use and material circularity:** Achieving environmental sustainability in the EV transition requires a holistic approach that considers the entire lifecycle of EVs and addresses energy and material use at every stage. While EVs produce zero emissions at the tailpipe, their overall environmental impact depends on the source of electricity used to charge them. Using renewable-based energy will be important to minimise the carbon footprint of EVs.

   Similarly, batteries for EVs require significant amounts of raw materials such as lithium, cobalt, and nickel. Sustainable mining practices, recycling of batteries, and research into alternative battery chemistries with fewer rare or toxic materials will be essential for reducing material extraction and use, and overall environmental impacts.[5]

   The policies and incentives for EVs, therefore, should integrate provisions for RE use, material use, and disposal, among others, to support an environmentally responsible EV transition.

   Overall, the way ahead for the transition from ICE to EV, should not be limited to a mere sectoral approach, it should be harnessed as an opportunity to support broad-based green economic growth and green jobs, promote sustainable urban mobility and urban environment, ensure a green energy future and a circular economy.

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Notes

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