Scoping Study and Policy Imperatives on Green Jobs and Eco-Entrepreneurship Opportunities for Women in Select States in India.

GREEN TRANSPORT

Green jobs and Eco-Entrepreneurship has been integral to the discourse on green growth/economy for over a decade and has assumed greater significance of late. This study - Scoping Study and Policy Imperatives on Green Jobs and Eco-entrepreneurship Opportunities for Women in Select States in India was initiated in early 2020 and draws upon the learnings from the United Nations Development Programme (UNDP)'s project "Creating Employment and Entrepreneurship Opportunities for Women in India" (Disha) project. The intent of the study is to identify areas for and promote greater women's workforce participation in renewable energy, green construction, green transport, water management and carbon sinks (forests and marine fisheries). Given the vastness of its scope and geographies, the study was confined to the UNDP's Inclusive Growth project states of Delhi, Haryana, Maharashtra, Karnataka, Telangana, Uttarakhand and Odisha.

The report, prepared by KPMG, is based on secondary sources and stakeholder interactions, as the study was initiated just prior to the COVID-19 pandemic and lockdown, that greatly limited access to primary research, physical consultations and data collections. Even though virtual stakeholder interactions, online consultations and peer review provided information across thematic areas, it is likely that there may be some gaps due to unavailability of gender disaggregated data or restricted information.

The report is edited and designed by Roots Advertising.

Published by:
UNDP India
55, Lodhi Estate, New Delhi 110003, India
Tel: +91-11-46532333,
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Scoping Study and Policy Imperatives on Green Jobs and Eco-entrepreneurship Opportunities for Women in Select States in India

GREEN TRANSPORT

Contents

List of Abbreviations

AEDEI	Advance Electrical Design and Engineering Institute
AEVT	Academy of EV Technology
AI	Artificial Intelligence
B2B	Business to Business
BAU	Business as Usual
BESCOM	Bangalore Electricity Supply company Ltd.
BEV	Battery Electric Vehicles
BSES	Bombay Suburban Electric Supply
CEA	Central Electric Authority
CEEW	Council on Energy, Environment and Water
CKD	Completely Knocked Down
DISCOMS	Distribution Companies
EESL	Energy Efficiency Services Ltd
EV	Electric Vehicle
EVSE	Electric vehicle supply equipment
FAME	Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles
FY	Financial Year
GDP	Gross Domestic Product
GUTS	Green Urban transport Scheme
HEV	Heavy Electric Vehicles
HMRL	Hyderabad Metro Rail Limited
HVT	Hybrid Vehicles Training
IC	Internal combustion
ICE	Internal Combustion Engine
INDC	Intended Nationally Determined Contribution
LEV	Light Electric Vehicles
LTR	Learn to Ride
ML	Machine Learning
MoH&UA	Ministry of Housing & Urban Affairs
MoHIPE	Ministry of Heavy Industries and Public Enterprises
MoP	Ministry of Power
MoRT&H	Ministry of Road & Highways
MoST	Ministry of Science & Technology
NEMMP	National Electric Mobility Mission Plan
NMT	Non-motorized transports
NPTI	National Power Training institute
NTPC	National Thermal Power Corporation
OEM	Original Equipment Manufacturers
PDI	Pre-Delivery Inspection
R&D	Research & Development
RSAP	Ride Safe Awareness Program
RSP	Ride Safe Program
SDI	Skill Development Initiative
SIAM	Society of Indian Automobile Manufacturers
SHGs	Self Help Groups
SMEV	Society of Manufacturers of Electric Vehicles
YoY	Year on Year

Foreword

Climate change is perhaps the biggest challenge of our times and it is forcing all of us to define the kind of economy that works for everyone. The effects of climate change will undoubtedly alter the structure of employment; new jobs and new job families will emerge, others will evolve or become unsustainable. Economies must find ways to reorganize work and production differently.

According to ILO, at least half of the global workforce, around 1.5 billion people will be affected by the transition to a greener economy. The challenge lying ahead of us is the urgent need to equip the people with the right skills that will help them adapt to this transition. Skills gaps have already started emerging across a number of sectors, such as renewable energy, energy and resource efficiency, renovation of buildings, construction, environmental services and manufacturing.

Moreover, the exclusion of women and their needs in decision-making process for mitigation or adaptation measures can pose challenge to achieving gender equality at work. This will have a deep impact on the larger economies. Given that women make up a little over half of the world's population (WEF 2013), their untapped talent could significantly alter our economic development (UNDP 2013).

Nearly 60 percent of India's population is directly dependent on climate-sensitive sectors such as agriculture, fisheries and forestry for its livelihoods, and 80 percent of economically active women are in the agriculture sector. Hence the climate crisis severely affects the women who are dependent on these climate-sensitive livelihoods and who do not have any alternative livelihoods.

Keeping in mind these multiple challenges and based on our learnings from Disha Project that UNDP implemented in partnership with IKEA Foundation, to create employment and entrepreneurship opportunities for women, a study was commissioned to assess the green jobs and eco-entrepreneurship opportunities for women in India. The study focused on five major sectors identified by the Skill Council for Green Jobs: renewable energy, green transport, green construction, forestry, fisheries and water management. It covered Delhi NCR (National Capital Region), Haryana, Maharashtra, Karnataka and Telangana as well the potential states such as Uttarakhand and Odisha.

Although we faced the challenge of lack of gender-disaggregated data, and the study being conducted during the COVID- 19 pandemic, the sector-specific reports present some promising prospects for a greener skilling and livelihoods ecosystem. The Government of India and some of the state governments are already moving in the right direction. For instance, the International Solar Alliance in the Renewable Energy space has already gained momentum and the cost of the solar panels in India has reduced in the recent years.

While substantial work has been done to build capacities of people and communities on water management, forest or fisheries, to promote climate-resilient practices, women are often left out and mostly under-represented in such initiatives. As we recover from the pandemic, we must ensure that women are given equal opportunities to be part of our green recovery. Only when we tap into their talents and the huge demographic dividend that is often left out, can we achieve our Sustainable Development Goals at the end of this decade.

UNDP has been working closely with the Government of India and other key partners for an inclusive and climate-sensitive response to COVID-19 that paves the path to greener pathways for recovery. India, as an emerging economy, holds immense potential, given its demographic dividend. But it can never recover fully, or reach its full potential, if half of the population – the women- are not part of its green recovery.

Shoko Noda
Resident Representative

Acknowledgement from Lead Facilitator

UNDP India has undertaken a study on the "Scoping Study and Policy Imperatives on Green Jobs and Eco-Entrepreneurship Opportunities for Women in Select States in India". The report takes into cognizance the climate crises and its implications on lives and livelihoods of the people, and provide some pathways in terms of nature-based livelihoods, that can often be turned into opportunities for more decent work. Be it renewable energy, green transport, green construction water management, forest or fisheries, strides are being made by the Governments at national and state levels to build the capacity of the people and promote climate-resilient practices. And it is but appropriate to bring in the women to partake in the development and be part of the dynamic workforce in the country. And this forms the basis of the study.

This report has been made possible with contributions from many individuals and experts, who took out time and helped put this study together. This report was initiated just prior to the onset of pandemic and was drafted virtually through the lockdown period. A number of virtual consultations with thematic and regional experts were held between April and November 2020, and inputs received on each of the chapters drafted.

In this endeavour, we owe our deepest gratitude to Dr. Sunita Sanghi (Additional Secretary and Senior Advisor, Ministry of Skill Development and Entrepreneurship, Government of India), Dr. Praveen Dhamija (Advisor, Sector Skill Council on Green Jobs), Vandana Bhatnagar (Chief Programme Officer, NSDC), Sudipta Bhadra (Senior Programme Officer, ILO), and Anubha Prasad (National Coordinator, PAGE) for their guidance while discussing our findings, assessing the quality of analysis, the reliability of data, and the soundness of the recommendations emerging from the study.

The support provided by our collaborators in the formulation of background papers needs a special mention. We express our utmost appreciation for the hard work put in by the KPMG team lead by Manpreet Singh and Vivek Panda.

We would like to thank and acknowledge the inputs received during the peer review of the draft chapters by Dr. Srinivas Shroff Nagesha Rao (CEO, REC Foundation), Hitesh Vaidya (Director, NIUA), Suneel Padale (Director Programs, CARE India), Vishaish Uppal (Livelihoods Specialist, WWF India), Moho Chaturvedi (Independent Consultant) and Ramya Rajagopalan (Independent Researcher).

Our gratitude to UNDP colleagues for their insightful comments during the peer review process. Our heartfelt appreciation for the overall insight and guidance by Harsh Singh, Amit Kumar, Alka Narang, and the contributions by UNDP India team, especially Sushil Choudhury, Saba Kalam, Dilip Singh, Abha Mishra, Rashmi Bajaj, Manisha Choudhury and colleagues from the Inclusive Growth team.

We are eternally grateful to Ms. Shoko Noda, Resident Representative, UNDP India and Ms. Nadia Rasheed, Deputy Resident Representative, UNDP India for their inspiration, encouragement and guidance throughout the process. None would have materialised without the faith that they reposed in our endeavours.

We thank all the experts and colleagues for their support and contribution.

Swayamprabha Das
Inclusive Growth

Executive Summary

As action against climate change gains momentum, there is enhanced focus on mitigating global greenhouse gas emissions among countries. India, in its intended nationally determined contribution submission in 2016, has pledged to reduce the emissions intensity of its gross domestic product (GDP) by 33–35 percent by 2030 below 2005 levels. While the targets span sectors, transport continues to be one of the key focus areas for achieving reduction in emissions intensity of the GDP. In this context, the green transport sector is seen as an emerging industry offering various employment opportunities in the future.

Over the last decade, several national and state-level regulatory and policy interventions have targeted 30 percent electric mobility in the country by the year 2030. Various studies have been conducted in the electric vehicle (EV) segment to estimate job growth in the sector. One such study has been discussed in this report which aims to assess employment growth for 30 percent EV penetration by 2030 (EV30) with an enhanced government push vis-a-vis the business-as-usual scenario (with no rigorous effort to enhance demand or supply of EVs). The study concludes nearly 400,000 new jobs are expected to be created by 2030. This will entail reduced job growth for the internal combustion engine segment by 20 to 25 percent without any job losses in the automotive industry.

The electric mobility sector, though it is growing rapidly, is still in its nascent stage in India and is encumbered with multiple challenges. One of the major roadblocks towards adoption of EVs in the country is the lack of reliable, accessible and affordable charging infrastructure. Additionally, lack of skills across the manufacturing and charging infrastructure segments of the value chain pose a serious challenge to the original equipment manufacturers looking to expand in the sector. While skill gaps persist, gender disparity in the workforce contradicts the human development approach to sectoral growth.

Several success stories are analysed to develop key recommendations for the sector. While bridging the skill gap is a key focus area, recommendations include several measures to increase participation of women in the workforce and promote eco-entrepreneurship in the sector.

With the novel coronavirus outbreak, the automotive industry is expected to undergo a period of prolonged slowdown. Due to disruption of supply chains and production processes and shortage of crucial components, the EV segment is expected to witness supply-side blockages. However, demand is expected to pick up as people switch from crowded public transport to EVs, with no or minimal additional cost. To overcome supply-side challenges, enhanced collaboration of Indian and international players for setting up a manufacturing base in the country is recommended. Additionally, domestic production of battery components would facilitate greater indigenization for faster recovery and green growth of the sector.

Disclaimer: All the estimations that have been made in this report are suitable for a pre-COVID scenario.

The Indian automotive sector employed over 1.3 million people in fiscal year 2017. The employment figures were relatively small compared to the EU automotive industry that employed around 14 million personnel. In the United States, part dealers and motor vehicle sector had around two million employees on their payrolls in March 2019. Even then, India had one of the largest global automotive markets in 2019. The sector however, started facing the effects of a slowdown in terms of sales and rising inventory numbers mid-way through 2019.

EMPLOYMENT LOSS

Slumping sales and halts in production triggered massive job cuts throughout the industry. Component manufacturers and dealers had to lay off around 350 thousand workers since April 2019. The adversity was not limited to automakers only. Tire manufacturers also had to cut down the workforce due to the sales slump. Temporary suspension periods were also implemented by leading carmakers in the face of declining demand.

IMPACT

The automotive industry contributes a share of about seven percent to India's GDP each year. It also accounted for almost half of the country's manufacturing output. Maruti Suzuki, the country's biggest carmaker, reduced its temporary workforce by about six percent. Tata Motors and Mahindra on the other hand, faced periods of stagnant productions.

The Indian Government has the ambitious target of ensuring that only electric vehicles are sold in the country within the next few years. The Ministry of Heavy Industries has shortlisted 11 cities in the country for introduction of electric vehicles (EVs) in their public transport systems under the Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles in India (FAME) scheme6. The first phase of the scheme has been extended to March 2019. In February 2019, the Government approved the FAME-II scheme with a fund requirement of INR 10,000 crore (US$1.39 billion) for FY20-22. The number of vehicles supported under the FAME scheme increased to 192,451 in March 2018 from 5,197 units in June 2015.

The electric vehicle (EV) market is estimated to be a Rs. 50,000 crore (US$ 7.09 billion) opportunity in India by 2025. Several technology and automotive companies have expressed interest and/or made investments into the India EV space. Auto companies such as Hyundai, MG Motors, Mercedes, and Tata Motors, have launched EVs in the market. A recent study conducted by Castrol found out, most of Indian consumers would consider buying an electric vehicle by the year 2022. The study also highlighted for an average Indian consumer, price point of Rs. 23 lakh (or US$ 31,000), a charge time of 35 minutes and a range of 401 kilometers from a single charge will be the 'tipping points' to get mainstream EV adoption.

Indian Automobile Industry Report (November, 2020) https://www.ibef.org/industry/automobiles-presentation

1

Overview

1.1 SETTING THE CONTEXT

Transportation is an integral part of the society. Good transport infrastructure has now become the need of the hour for the socio-economic development of a country. Internal Combustion(IC) engine being the backbone of automobile sector has resulted in causing negative environmental impacts. This calls for an alternative solution to reduce the dependency on natural fossil fuels.

With the potential to reduce oil imports, address air pollution in cities, and help meet India's climate commitments by reducing the energy intensity of the GDP, the shift towards electric mobility can stimulate the growth of new industries and activities.[1] This transition, however, requires development of new skills and knowledge around the entire electric vehicle ecosystem, paucity of which hampers the growth of the sector and restricts the participation of women in the sector.

This report thus presents sectoral analysis of green transport sector in India, outlines policies in place pertinent to green jobs, ways to enhance women participation in the sector and eco-entrepreneurship opportunities for women in selected states..

BACKGROUND

This scoping study on Green Jobs and Eco-entrepreneurship opportunities for women in select states, draws its strength and learning from the UNDP-IKEA Foundation project 'Creating Employment and Entrepreneurship Opportunities for Women in India (Disha)'. This project focused on enhancing opportunities for marginalized women in jobs and entrepreneurship and enabled development of models and curriculum like the Biz Sakhi and Women Sourcing Managers. Though some of the pilots under Disha did include components of green initiatives, but a full-fledged pilot/programme could not be developed majorly because of lack of disaggregated data/ information. But as the conversations around jobs/ entrepreneurship - climate change nexus gathered momentum, a need was felt to design a study to fill this gap and develop sector specific pathways with a focus on marginalised women.

While the discourse on Green Economy/Green Growth is huge and covers a range of sectors, the study focuses on addressing the following two-fold objectives:

- Gap assessment of existing and potential green jobs and mapping the availability of skilled workforce for the identified job roles in the RE sector; and
- Development of an implementation roadmap and provision of recommendations to enable women to leverage the existing and potential opportunities.

Given the limitation and the acceptance that many areas in the Green Jobs sector is still evolving and maybe in nascent stage, the geographic scope of the study was limited to the states of Delhi NCR, Haryana, Maharashtra, Karnataka, Telangana, Uttarakhand and Odisha.

APPROACH AND METHODOLOGY

Scope of the study includes the following five phases: finalization of methodology and assessment framework, secondary research and assessment, primary stakeholder consultation, analysis and report writing. In each phase, various tasks as suggested in the scope will be performed to ensure completion.

Scope of the Study

Under Green Transport, the focus of the study would be on Electric Vehicles including passenger and commercial vehicles. Taking into consideration all the health and environmental advantages, this industry has the potential to grow and offer various employment opportunities in future. Also, the Government has set a target to achieve 30% e-mobility in the country by the year 2030 and all the efforts that Government is putting to make the transport sector electric through various national and state level schemes/ initiatives, offering various tax benefits and subsidies makes the electric vehicle space the center of Green Transport sector.

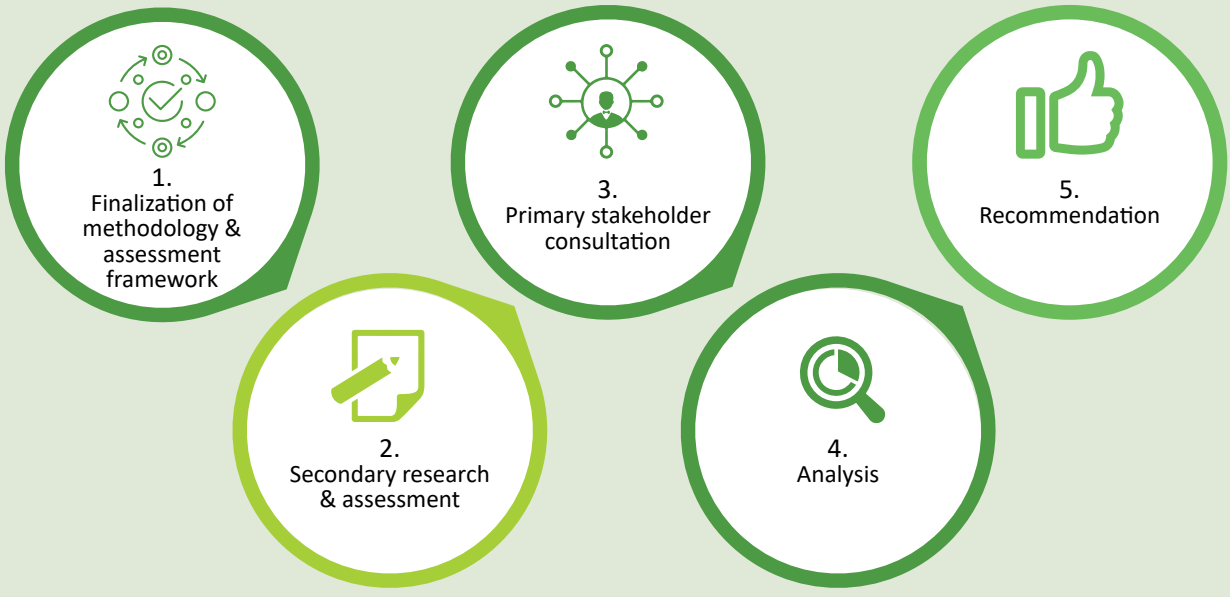
LIMITATIONS OF THE STUDY

The uniqueness of this assignment is an opportunity to explore and find a way forward but it also presents its own set of challenges, particularly in terms of paucity of data. The analysis conducted in the study is bounded by the following limitations:

- Lack of sector-specific data on women currently engaged in unskilled and semi-skilled job roles in the selected states;
- Consequently, an estimation of the growth forecast for semi-skilled and unskilled job roles in the sector is a challenge;

[1] Soman, Abhinav, et al., 2019. India's Electric Vehicle Transition Impact on Auto Industry and Building the EV Ecosystem.

Figure 1: Approach and methodology



- Since it is an upcoming industry, information about skill gaps for the EV industry is limited at this point of time. Also, there is lack of data on skill gaps pertaining to women in the EV sector;
- There is limited or no information about institutes training women in the EV sector; and
- Information about cases studies involving women in the EV industry is limited.

1.2 INTRODUCTION

Transport drives economic and social development, offering opportunities to the poor and enabling economies to be more competitive. Transport infrastructure links people to jobs, education and health services, builds markets and facilitates trade. This sector accounts for about 64 percent of global oil consumption, 27 percent of all energy use, and 23 percent of the world's energy-related carbon-dioxide emissions.[2] Within the sector, road transport accounts for nearly 75 percent of cumulative greenhouse gas (GHG) emissions and the trend is projected to increase in the future if it continues unabated.

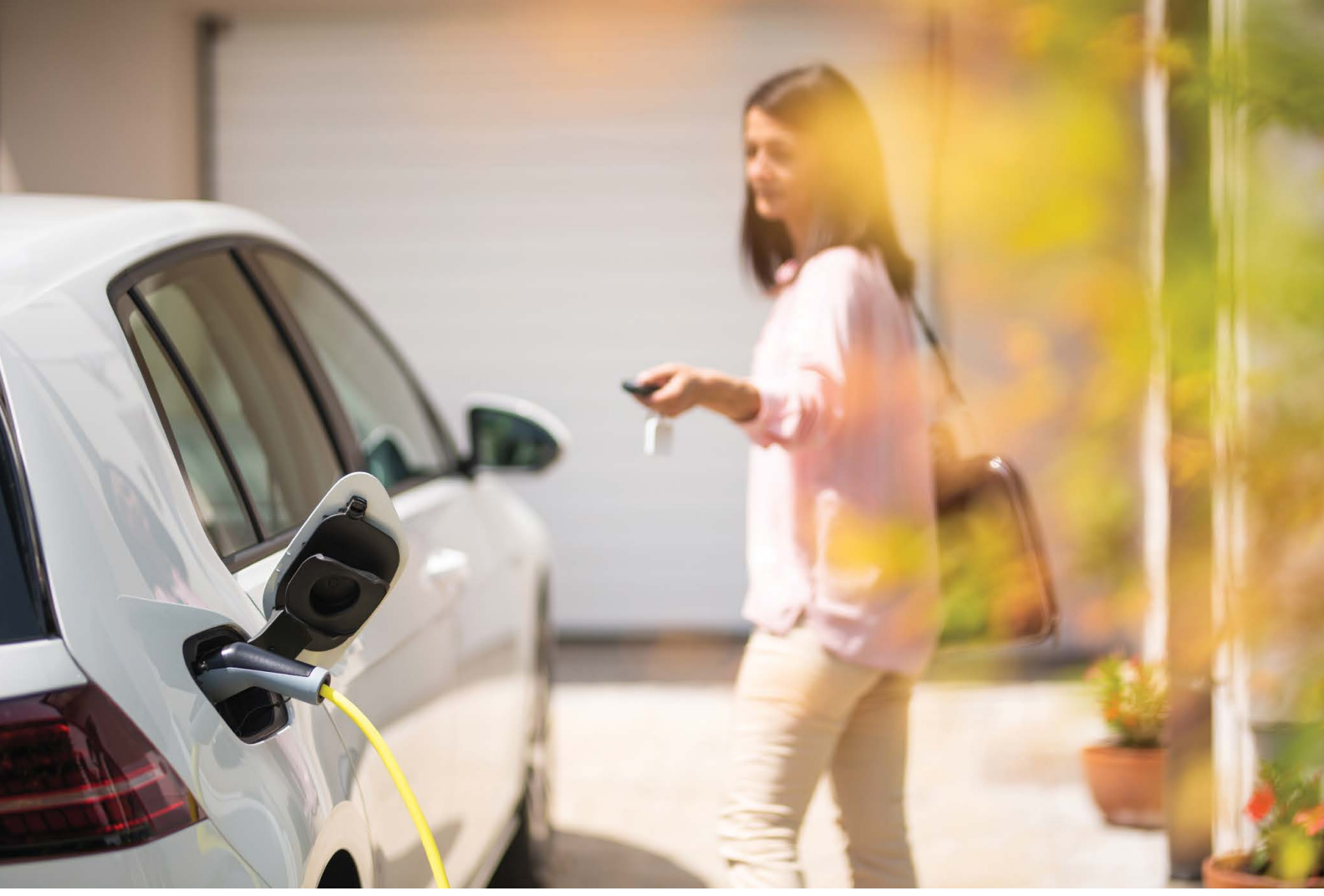
In India, 14 percent of the gross domestic product (GDP) is spent on the transport and logistics sector.[3] Automobiles make a 7.1 percent contribution to the GDP and employment whereas the auto components industry has a 2.3 percent share.

The automotive sector in India primarily depends on internal combustion (IC) engines which utilize fossil fuels as a source of energy. Combustion of fossil fuels releases large amounts of toxic gases that pose a serious threat to the environment and human life. All these issues necessitate an innovative solution in terms of hybrid vehicle technology to fulfil the world's requirement for a greener environment.[4]

DEFINING GREEN JOBS

International Labour Organization (ILO) defines green jobs as, "Green jobs are decent jobs that contribute to preserve or restore the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency."

[2] https://www.worldbank.org/en/topic/transport/overview
[3] https://www.indiaservices.in/transport
[4] Green Transportation in India: Need Analysis and Solution, 2014, Aishwarya Panday and Hari Om Bansal



According to ILO, decent work involves "opportunities for work that is productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men".[5]

United Nations Environment Programme defines green jobs as "work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution".[6]

For the purpose of this study:

'Green' implies:

- Limiting or preventing negative environmental impacts, such as pollution, of ecosystem components such as air, water and soil;
- Being climate friendly via minimization of resource wastage;
- Maximizing resource efficiency; and
- Focusing on resource conservation.

'Green jobs' include social considerations such as improvement of working conditions, promotion of health and well-being, better livelihood generation, community development, etc. Green jobs can be existing or may require, reskilling, upskilling or developing new skills.

5 Decent work, ILO, https://www.ilo.org/global/topics/decent-work/lang--en/index.htm
6 Green Jobs, Food and Agriculture Organization of the United Nations, http://www.fao.org/rural-employment/work-areas/green-jobs/en/

DEFINING ECO-ENTREPRENEURSHIP

Entrepreneurship is an area that is linked to the economic development of any economy by accelerating its growth and prosperity. Last few decades have shown the emergence of women as entrepreneurs both in developed and developing economies. It is evident that women entrepreneurs have greatly contributed to improved poverty levels and creation of various employment opportunities.[7] These principles of entrepreneurship can also be applied to create sustainable business models while tackling environmental issues at macro level. This is known as eco- entrepreneurship, wherein businesses operate sustainably contributing to economic development and improved environmental quality.

DEFINING GREEN JOBS FOR TRANSPORT

In the automotive sector, green jobs can include both hybrid and electric vehicle production, sales, and repair. The demand for these specialized roles increases as the hybrid and electric car industry flourishes.[8]

NITI Aayog has developed a framework for 'Transforming India's Mobility' based on an extensive study of global examples and learning from India's past efforts. The overall objectives defined as 3Cs are as follows:

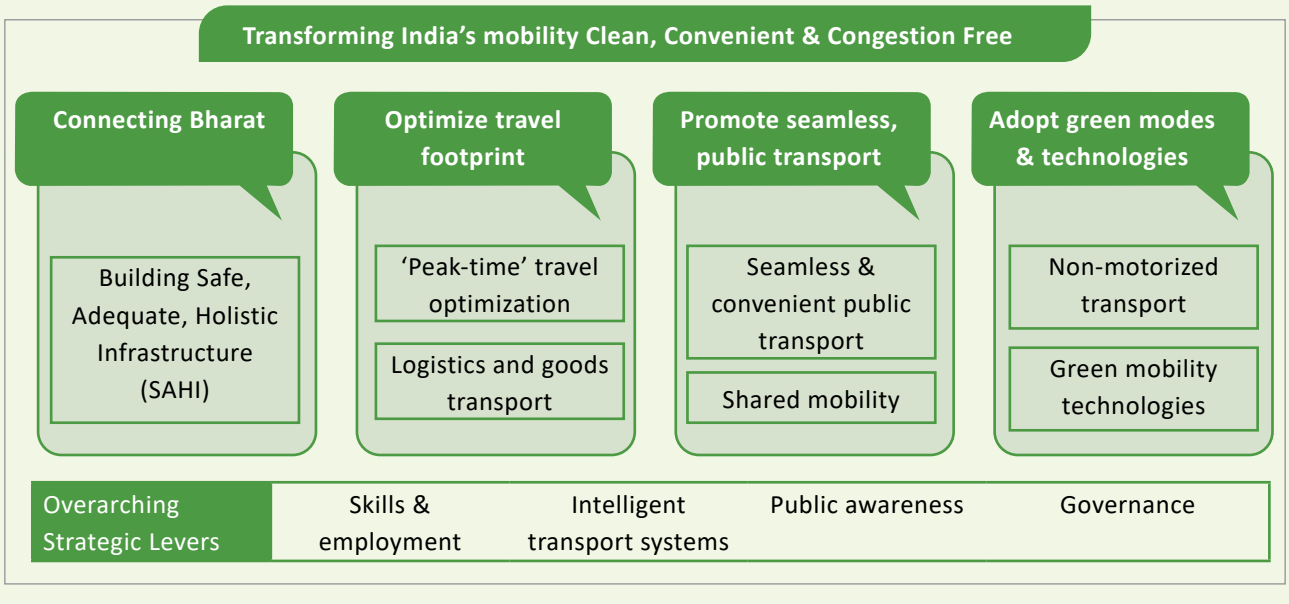
- Clean: Pollution-free, leading to clean air and hence better health and living standards;
- Convenient: Seamless, safe, affordable, accessible for all sections of the society and connected both in terms of technology as well as connecting key rural and urban centres; and
- Congestion-free: Minimum congestion levels and hence enhanced economic efficiency.

One of the key pillars defined in the framework is 'green modes and technologies'. The switch to green modes of transportation has certain advantages and involves modification of the transport industry's structure and making healthier travel choices.

Green transportation (or sustainable transportation) comprises those modes of transportation that do not depend on diminishing natural resources such as fossil fuels. These include:

i. Non-motorized and public transport:
   - Non-motorized transports (NMT) mainly involve walking, cycling, cycle rickshaw and other alternatives such as small-wheeled

Figure 2: Transforming India's mobility



7 Women Entrepreneurship in India: A Literature Review, 2017, Neha Tiwari
8 https://ehsjobs.org/greenjobs-transportation.htm

transport (skates, skateboards, push scooters and hand carts). These modes offer the benefits of low carbon footprint, minimum energy consumption and zero local emissions. Low- income groups in India are largely dependent on NMT on a daily basis. Apart from the environmental benefits, active transportation in the form of walking and cycling has great health benefits as well.[9] These modes provide both recreation and transportation (access to goods and activities)[10]; and

- Currently, the maximum use of public transport in the world is in India, close to almost 25 percent (excluding non-motorized transit) across major cities. Ninety percent of this share comes from buses that accounts for 30–40 percent of the mode share in major Indian cities. Increased use of public transport leads to a reduction in congestion levels and energy use.[11]

ii. Efficient and less polluting modes:

- These technologies have a minimum impact on the environment and have known benefits for reducing GHG emissions. Such technologies include EVs, plug-in hybrid EVs and hydrogen fuel cell vehicles.[12]

GREEN JOBS FOR WOMEN IN THE TRANSPORT SECTOR

While the overall workforce participation in the EV segment remains dismal, female employment in the sector is likely to be significantly lower as compared to the auto industry numbers. Since the EV sector is still emerging, data and disaggregated data is not readily available.

Below is a case study of increased foray into the sector by women entrepreneur:

Dehradun gets its First Woman e-Rickshaw Driver

- Gulista Ansari, a 26 year old female from Dehradun became the city's first female E- rickshaw driver after her decision of quitting her earlier workplace.
- While working for her former company, Gulista realized that the number of hours she was putting in her job and meagre income she was earning was not sufficient to sustain her family.
- Under all these circumstances, she resigned from her job and took a bank loan of Rs 1,57,000 to buy a battery-operated rickshaw. Now she earns Rs 600 per day, plying the rickshaw from 8am to 8pm.[13]

1.3 IMPLICATION OF COVID-19 ON THE SECTOR

Transportation sector has been one of the primary victims of COVID-19. From rickshaw pullers to airlines, all have been affected economically by the pandemic. India's overall energy demand fell by 11% in March 2020.[14] Due to lockdown in many countries, the demand for passenger transport has been adversely hit. The freight segment has had a mixed short-term effect in terms of transportation demand. There is a surge in demand for truck drivers in transportation of essential goods.

Even after the situation normalises, the perception of risk associated with crowded areas could lead to shift in preferences towards personal travel modes. That is, people may avoid using public transport modes to avoid crowds. People may also avoid shared mobility modes like autorickshaws, micro-transit vans, e-rickshaws etc. The drivers employed in app-based taxi services are economically suffering in the short term due to the COVID lockdown. However, it cannot be said if these modes may face long term economic effects in terms of reduced travel demand.[15] Many players in the transportation sector are adapting to these changing demands. For instance, American Airlines and some

[9] Non- Motorized Transport Policy in India, 2015, GIZ
[10] Non- Motorized Transport Planning, 2018, Victoria Transport Policy Institute, https://www.vtpi.org/tdm/tdm25.htm
[11] Enabling the Transition to Electric Mobility in India, 2017, Rocky Mountain Institute
[12] What you can do to Reduce Pollution from Vehicles and Engines, 2017, United States Environmental Protection
[13] Agency https://www.epa.gov/transportation-air-pollution-and-climate-change/what-you-can-do-reduce-pollution-vehicles-and-engines
[14] https://economictimes.indiatimes.com/industry/energy/oil-gas/indias-fuel-demand-drops-11-in-march-as-coronavirus-hits-aviation-transport/articleshow/74711994.cms?from=mdr
[15] Effects of COVID-19 on Transportation Demand | TERI (teriin.org)

of its peers have converted many of the passenger flights to carry goods.[16] In China, autonomous vehicles were piloted to provide 'touchless' service to provide delivery issues while reducing the risk of spread of the disease.[17] Indian Railways have simultaneously cancelled passenger trains and ramped up parcel services and other freight services for essential commodities. In Bengaluru, Three Wheels United (TWU), a city-based social enterprise, launched a program for auto drivers to deliver medicines, groceries and other essential goods to the residents. Unfortunately, this program hit a roadblock regarding permissions from the authorities to operate during the 21-day lockdown in India.[18]

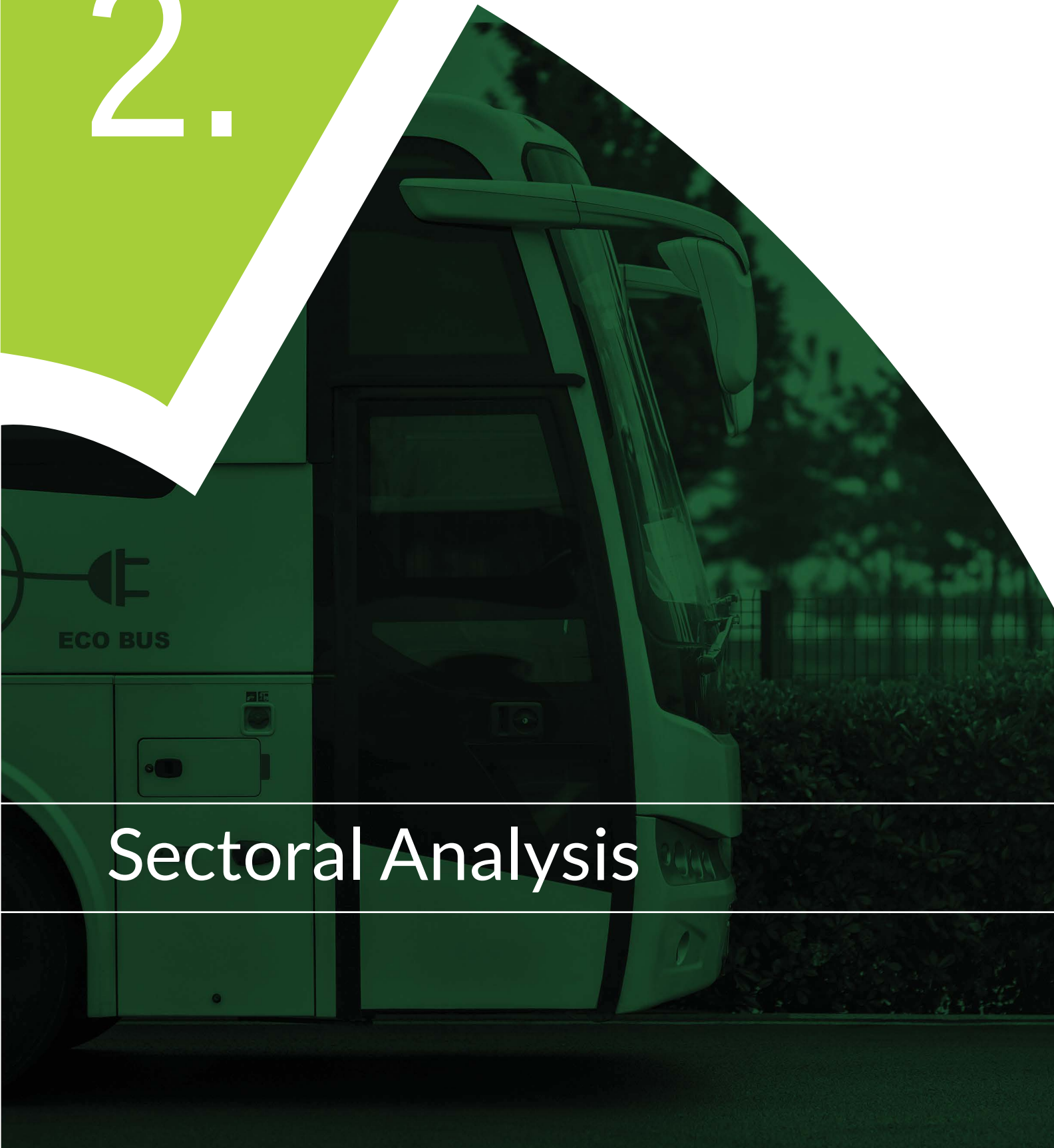
According to a recent policy brief from ILO[19], "The pandemic has affected workers in different ways. Although some countries have relaxed working time regulations, for example, it remains crucial that workers do not operate transit vehicles while fatigued.[20] Quarantine measures, self-isolation, workers on sick leave or absenteeism may have led to workforce shortages putting additional stress on business continuity and scheduling procedures. Other cases include a complete halt or shutdown of urban transport operations, with a devastating impact on workers and their wages. In particular, informal workers depend on providing transport services for their livelihoods."[21] The brief further goes on to say that – "the pandemic may, however, present new opportunities to formalize employment, including through strengthened social protection systems, in line with the Transition from the Informal to the Formal Economy Recommendation, 2015 (No. 204). In particular, for small-scale informal transport, social protection demands can constitute a building block to start formalizing workers.[22] Women are on the sharp end of this pandemic, as they are often in jobs with low or lower pay or have a low or lower status relative to men, with few, if any, opportunities for career development.

In report from World Business Council for Sustainable Development (WBCSD)[23] according to the European Automobile Manufacturers Association (ACEA), registrations of new EVs in Europe doubled in the first quarter of 2020 despite most vehicle dealerships being closed in the latter part of the quarter. In May, in the UK, when new gasoline and diesel registrations were still down around 90% compared to the same time last year, EV sales were up 21.5%. Stimulus packages in Europe have increased the focus on EVs – and are largely aligned to the theme of building back better. Germany's COVID-19 stimulus package has seen the country doubling its EV incentive. Germany now delivers a €9,480 (USD $11,200) subsidy for EVs, with €3,480 (USD $ 4,110) of that chipped in by the original equipment manufacturers (OEMs). France has an even bigger subsidy, at €12,000 (USD $14,170) including a €5,000 (USD $5,900) scrappage scheme for older cars. China also announced an increased spend of USD $1.4 trillion on a digital infrastructure public spending program - and new-energy vehicle charging stations is one of the seven priority areas. China also produced 100,000 new energy vehicles in July 2020, up by 15.6% from a year earlier, with sales up by 19.3% to 98,000 units, according to data from China's Automotive Manufacturers Association (CAAM). In the US, the surge in Tesla's market capitalization is also being seen as reinforcing the fact that EV adoption is on the right side of investor sentiment in a post-COVID world. The national government remains committed to implementing an ongoing EV incentives program (USD $1.4 billion) focused on 2- and 3-wheelers, commercial vehicles and public transport buses and sub-national governments in Delhi and Telangana have recently announced their new and ambitious state EV policies. Building a domestic manufacturing eco-system is time-consuming and requires long-term planning. Changes in trade policies should minimize any negative impact on current and planned investments in EV manufacturing and adoption.

All these trends highlight a positive consumer and policy response to the crisis. This is likely to induce knock-on effects such as greater investments across the value chain and new vehicle announcements by global vehicle manufacturers.

[16] https://www.pymnts.com/coronavirus/2020/COVID-19-airlines-shift-from-passengers-to-cargo/
[17] https://www.weforum.org/agenda/2020/03/china-COVID-19-coronavirus-mobility-solutions/
[18] Effects of COVID-19 on Transportation Demand | TERI (teriin.org)
[19] COVID-19 and Urban Passenger Transport Services, Sept 2020, wcms_757023.pdf (ilo.org)
[20] Joe Kenny, "Staff management during COVID-19", UITP webinar, 1 April 2020.
[21] Anup Ojha, "Bus operators want officials to announce plans to resume public transport", in The Kathmandu Post, 20 June 2020
[22] Dan Mihadi, "The impact of COVID-19 on informal transport workers", ITF podcast, 10 April 2020.
[23] COVID-19 outlook for electric vehicles in India - https://www.wbcsd.org/Overview/News-Insights/WBCSD-insights/COVID-19-outlook-for-electric-vehicles-in-India

2.



Sectoral Analysis

Understanding the value chain within the EV segment helps to identify and map the areas with potential growth for green jobs in the transport sector with specific focus on enhancing participation of women in the workforce.

GAP ASSESSMENT

The value chain of a conventional vehicle is described in Figure 3. Most people in the sector are employed in the manufacturing and sales part of the value chain. The participation of women, however, is very low as compared to men, indicating gender disparity in the sector. This is because of a patriarchal mind-set, pre-conceived notions on lack of opportunities for women in the transport sector and various other factors. For women, a large proportion of jobs fall under later part of the value chain such as the customer service domains.

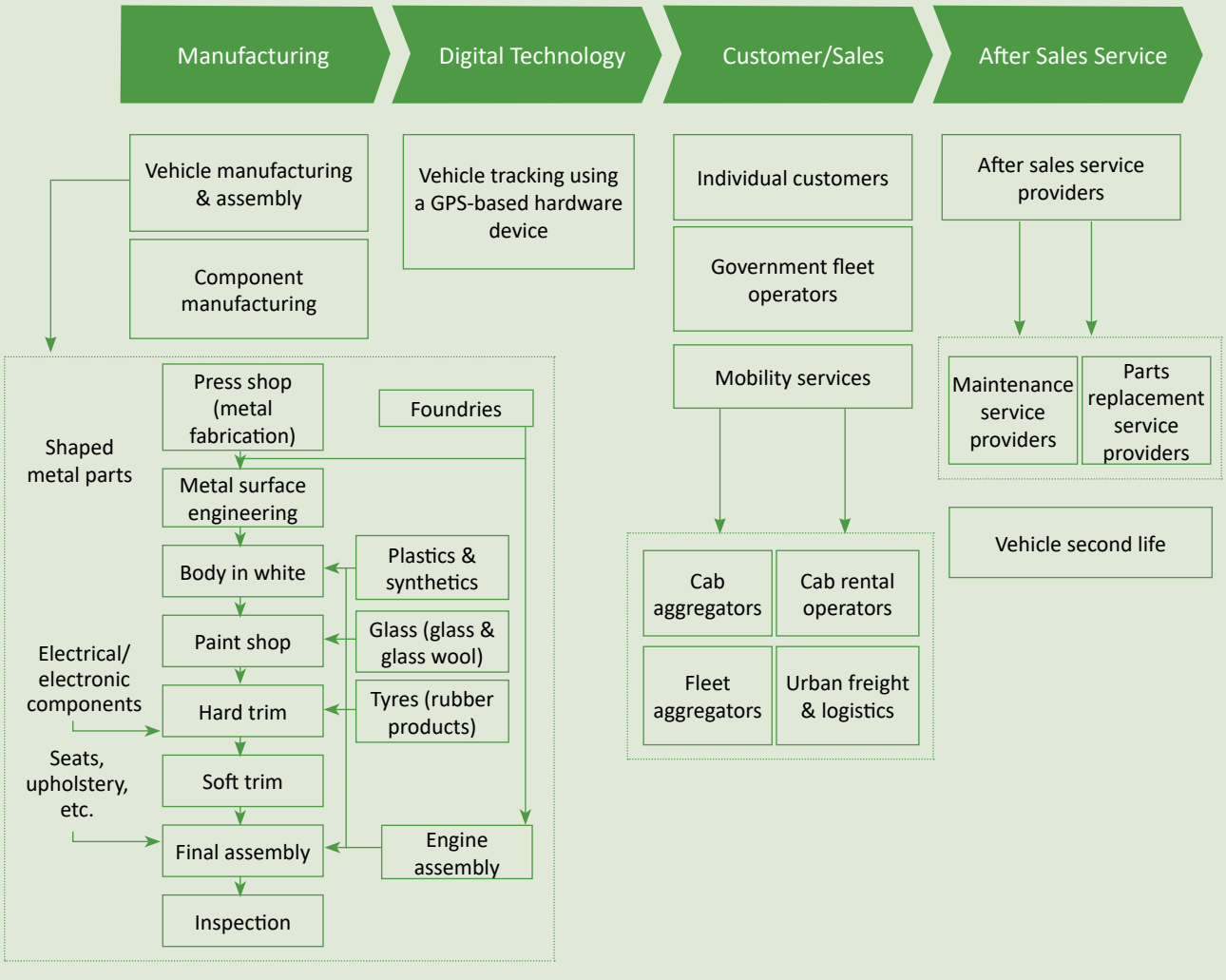
Conventional value chain

The conventional vehicle value chain consists of four components: manufacturing, digital technology, customers or sales and after sales service.[24]

Electric vehicle value chain

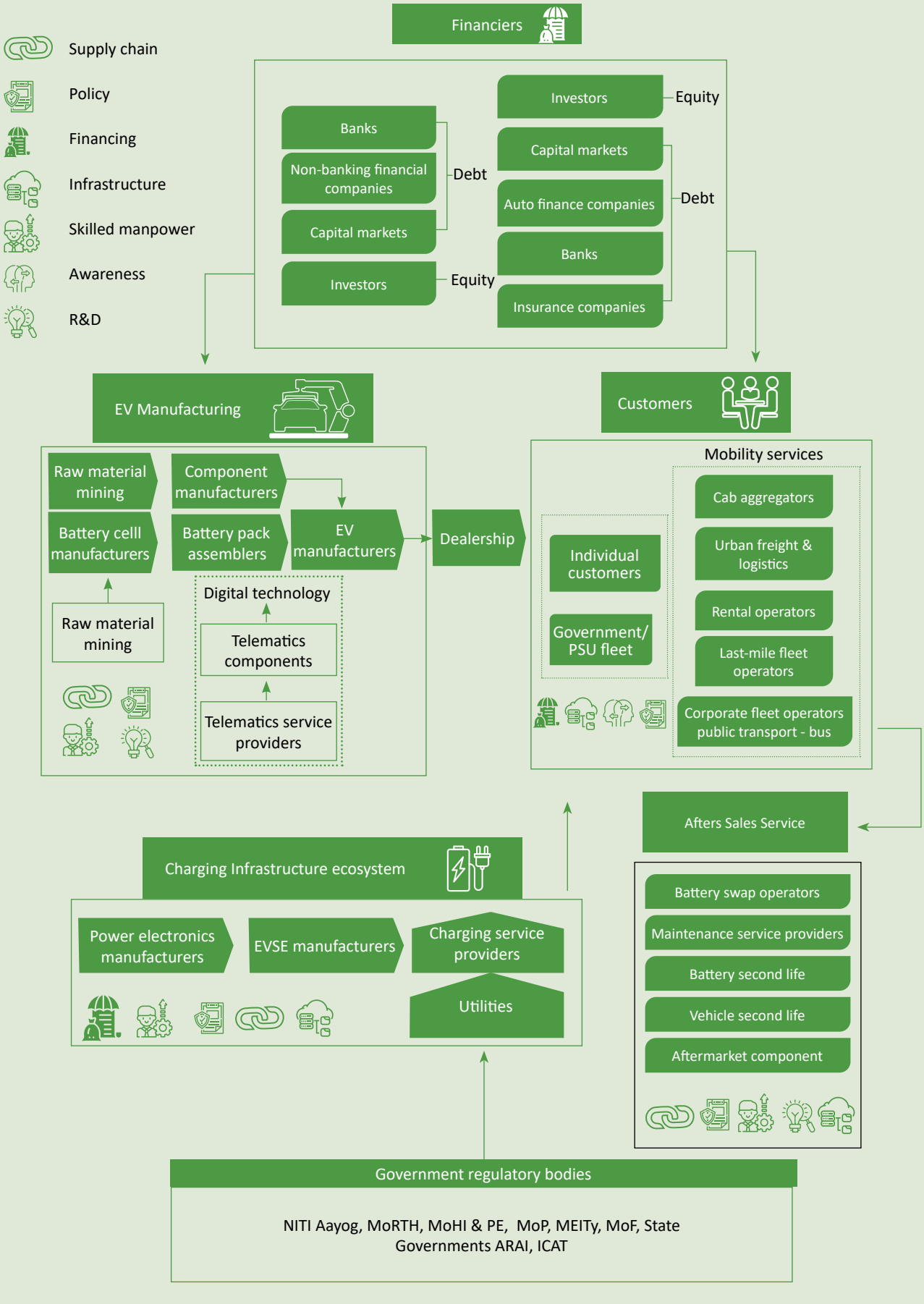
EVs do not consume petrol/diesel or produce tailpipe carbon emissions, placing the promise of an environmentally sustainable driving experience within reach of the average consumer. Hence, we see there are some significant differences between the two value chains. To study these variations, we first look at the EV value chain.[25]

Figure 3: Conventional vehicle value chain



24 India's Electric Vehicle Transition, 2019, Abhinav Soman et al.
25 India's Electric Vehicle Transition, 2019, Abhinav Soman et al.

Figure 4: EV value chain



There are some components in the internal combustion engine (ICE) sector which are replaced in the EV value chain. The existing infrastructure for ICE can actually be refurbished to suit the EV segment.

Table 1: Differences between conventional vehicle parts and EV parts

Fuel Tank	Replaced by battery that performs the function of energy storage
Fuel Pump	Replaced by a charger that puts energy/fuel into the vehicle to make it run
Fuel Engine	Replaced by an electric motor that causes the vehicle to move
Carburettor	Replaced by a controller that controls start, stop, speed, acceleration
Alternator	Replaced by DC/DC convertor that imparts power to accessories such as radio, lights, air conditioner and DC/AC convertor that converts DC to AC power to make the motor run[26]

Table 2 shows the different areas in which women's participation already exists. However, there is a huge gap that needs to be identified to enhance female participation in the sector by indepth analysis of the EV value chain and ecosystem.

Table 2: Job roles with women participation

Manufacturing*	Charging Infrastructure Ecosystem	Customer/Sales*	After Sales Service
• Service technician	(Minimal participation)	• Driver • Sales consultant • Manager • Customer service domain • Assistants	(Minimal participation)

* Positions where women's participation is currently observed

Description of EV ecosystem and the value chain

a) EV Manufacturing

- EV manufacturing incorporates various activities such as raw material mining, EV components manufacturers, battery cell manufacturers, battery pack manufacturers, and original equipment manufacturers (OEMs);
- The number of moving components in EVs is 21 percent less in comparison to a conventional ICE vehicle;
- Battery is the key component in an EV and involves a multi-stage manufacturing process. It begins with manufacturing of anode and cathode active materials, binder, electrolyte and separator. This is followed by assembly of these cells into a module and electronic management according to the required technical specifications. The next step is installing these modules together with systems that manage power, charging and temperature. Then integration of the battery pack into the vehicle structure takes place followed by the use of the vehicle and end of life which involves reuse, recycling or remanufacturing[27];and
- There is a higher number of lead plates in an automobile battery so as to facilitate quick and large amount of power for a few seconds unlike in invertor batteries that a give steady power output for a long time during engine starting. The invertor battery is normally known as a deep cycle battery and its battery plates are not damaged even in a deep discharge condition. In case of an automobile battery, there is definitely damage to the lead plates and reduced battery life.[28]

Gap: Manufacturing of EVs needs to grow domestically as there is currently a low level of EV production in India.

26 https://www.4-wheeling-in-western-australia.com/electric-vehicles.html
27 Soman, Abhinav, et al., 2019. India's Electric Vehicle Transition.
28 https://upsinverterinfo.com/difference-between-automobile-battery-and-inverter-battery.html

b) Financiers

- The need of financiers in the EV ecosystem is to cater to manufacturing, uptake by various customer segments, and electric vehicle supply equipment (EVSE) manufacturing and deployment.

  Gap: There is risk associated with financing EVs due to the lack of clarity on subsidies and other incentives once the subsidies and incentives are terminated.

c) Charging Infrastructure Ecosystem

- Wires, capacitors, transformers and other electronics parts fall under power electronics components. There are very few power electronics manufacturers in the Indian market today; most components required for the construction of an EV charging station are imported;
- These power electronics components, charge controllers and network controllers are then incorporated to manufacture an EV charger. There are a few EVSE manufacturers in the EV ecosystem; and
- For EVSE service provision, different business models are being followed:
  - Turnkey EVSE solution providers providing a complete end-to-end EV charging solution. This involves manufacturing the EVSE charger, installing it and operating it. They are the asset owners, providing charging solutions for consumers
  - EVSE operators that install and operate the EVSE charger. They are the asset owners, providing charging services to consumers
  - Charge network operators. Their function is to aggregate different EVSE outlets on a common platform for the consumers to charge their EVs.[29]

  Gap: The government has approved the setting up of 2,636 charging stations in 62 cities across the country by 2023. However, as of now, there are 250 public charging stations operating in the country representing a huge infrastructure gap in the growth of the EV sector.

d) Digital Technology

- Vehicle telematics involve four key components:
  a. Vehicle tracking using a GPS-based hardware device;
  b. Partnership with a telecom operator to provide data services;
  c. Partnership with a cloud hosting provider to provide a stable and reliable system; and
  d. Phone-based applications to provide data to consumers using a smart user interface.

  Gap: The difference between EV telematics and conventional telematics is that the former not only provides simple tracking and tracing solutions but also offers on-board diagnostics device-based solutions.[30] However, the skills around this domain have not yet been developed indicating a gap.

e) Customers

- Individual customers are the private vehicle users who purchase EVs for their own personal use. Electric two-wheelers and four-wheelers serve these customers well;
- Government fleet operators include companies like Energy Efficiency Services Ltd. a government-owned energy services company which was involved in bulk procurement of EVs by floating tenders;
- Cab aggregators involve the two-, three- and four-wheeler aggregators providing mobility services such as ride-hailing or ride-sharing
- Car-rental operators let the customers rent the vehicles for an hour, day, week or month;
- Last-mile fleet operators are the ones that provide first- and last-mile connectivity to users of public transport whereas corporate fleet operators serve corporate customers exclusively; and
- Urban freight and logistics comprise logistics services and last-mile urban freight service providers.[31]

  Gap: However, the upfront cost of EVs is so high that this mode of transport becomes unattractive to the consumers.

29 India's Electric Vehicle Transition, 2019, Abhinav Soman et al.
30 India's Electric Vehicle Transition, 2019, Abhinav Soman et al.
31 India's Electric Vehicle Transition, 2019, Abhinav Soman et al.

f) After-sales Service

- Battery swap operators let EV users swap discharged batteries for fully charged ones; and
- Two types of after-sales service providers will arise with EVs becoming more typical. These include maintenance service providers providing maintenance services for EV owners and parts replacement service providers offering replacement of battery and damaged parts for EV owners.[32]

Gap: Since there is an increased penetration of EVs in the market, a higher number of service centres needs to be set up.

Impact of COVID-19 on the EV Value Chain

With the novel coronavirus outbreak across the globe, many sectors will witness an unanticipated impact due to disruption in the supply chain and production processes. The automotive sector in India is moderately dependent on China for 18 percent import of automobile component and around 30 percent of tyre imports. Bulk dependency comes from the two-wheeler segment since a majority of two-wheeler components are imported from the country. Wuhan, the major hub for OEMs and part manufacturers, is the supplier to many tier 1 manufacturers and OEMs in India. The automotive sector in India has sufficient inventories for short-term support but the shortage of crucial parts can affect the OEMs. All these factors account for a major impact that the auto-industry will undergo with rapid spread of the disease across the world.[33]

SKILL ASSESSMENT

The focus of the study is on electric mobility that includes EVs. Hence, job roles that fall under different aspects of the EV value chain are considered green. Some job roles under different areas of the value chain are shown in Table 3. These are job roles that have been identified only for the unskilled and semi-skilled categories as per the scope of the study.

Table 3: Potential job roles in EV

Manufacturing	Charging Infrastructure Ecosystem	Digital Technology	Customer/ Sales	After Sales Service
SEMI-SKILLED AND UNSKILLED CATEGORY JOB ROLES				
New job roles identified				
• Equipment assembler • Tool designer and tool room supervisor • Tool room operator/ technician • Heat treatment shop supervisor • Heat treatment technician • Process try-out technician • Quality check supervisor • Supervisors • Draughtsman • Technician • Prototype manufacturing • Installation and commissioning technician	• Battery swapping attendant • Charging station operator	--	--	• Break battery and wiring specialist • Technical assistants • Technicians

32 India's Electric Vehicle Transition, 2019, Abhinav Soman et al.
33 Impact of COVID-19 on consumer business in India, 2020, Deloitte PoV

Manufacturing	Charging Infrastructure Ecosystem	Digital Technology	Customer/ Sales	After Sales Service
Job roles that require re-skilling				
• Assembly line supervisor • Maintenance assistant • Vehicle test driver	--	--	• Sales training manager • Accessory fitter • Sales executive (accessories value added services) • Sales consultant (automotive finance) • Showroom host • Sales consultant (pre-owned vehicles) • Sales consultant level 4	• Trainer - service • Automotive service Technician (2 & 3 wheelers) • Automotive engine repair technician level 4 • Automotive electrician level 4 • Automotive service technician level 4 • Maintenance technician-service workshop • Spare parts operations executive level 5 • Spare parts operations executive level 3 • Sales/service trainer
Job roles that require up-skilling				
• Draughtsman/ draughts person	--	--	--	--
SKILLED CATEGORY JOB ROLES				
New job roles identified				
• Battery line supervisor, battery handling and disposal arrangement supervisor • Battery fitting, associated wiring and charging technician • Manager - development and testing of charger • Testing engineers • Procurement engineers	• Charging station manager • Senior electrical and electronics engineer (EEE) • Production managers and EEE engineers • Technical assistants • Technicians	• Business unit head • Product marketing • Technology specialist and middleware expert • Web designer, hardware specialist	--	• Senior manager • Senior testing and servicing engineers • Testing engineers

Manufacturing	Charging Infrastructure Ecosystem	Digital Technology	Customer/ Sales	After Sales Service
Job roles that require re-skilling				
• Prototyping engineer • Manager test facility (R&D infrastructure) • Test engineer product/vehicle • Supervisor R&D testing (indoor, product)	--	--	• Regional sales manager (used/pre-owned vehicles) • Territory sales manager (used/pre-owned vehicles) • Product/brand manager • Regional dealer Development/ network expansion manager • Sales/service trainer (dealer) • Social media & digital marketing manager	• Regional manager - customer care • Regional parts manager • Area parts manager • Service training-in-charge centre

Some other potential job roles include:

a. Manufacturing (new jobs): Diagnostics and troubleshooting operator, battery fitting, associated wiring and charging technician, documentation supervisor, battery line supervisor, battery handling and disposal arrangement supervisor; and
b. Charging infrastructure ecosystem (new jobs): Charging station operator.

The EV segment itself is part of the huge auto industry. Jobs in the EV sector are very limited as of now as compared to the jobs in the transport sector since it is an upcoming industry and most components are imported from countries such as China, Japan and Korea.

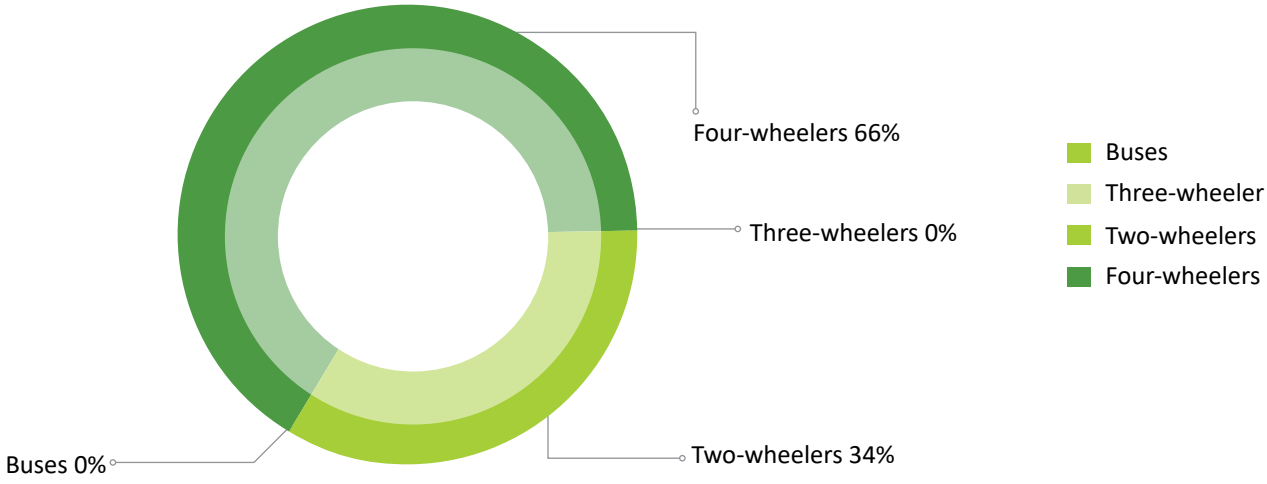
Current Level of EV Penetration

Under green transport, the study's focus would be on electric mobility which includes EVs. Taking into consideration all the health and environmental advantages, this industry has the potential to grow and offer many employment opportunities in the future.

However, the participation of women in this sector as compared to men is very low. Thus, it is crucial to achieve gender parity through necessary interventions in the sector.

Current level of penetration and sales:[34]

Figure 5: Number of EVs and hybrids sold under FAME



- 759,600 units of EVs were sold in Financial Year (FY) 2019 including electric two- wheelers (126,000), electric three-wheelers (630,000), and electric passenger vehicles (3,600). A 130 percent year-on-year growth was observed in the electric two- wheeler domain due to the release of the Faster Adoption and Manufacturing of (Hybrid and) Electric Vehicles (FAME) - II scheme.[35]

Table 4: EV sales in FY 2018

Segment	FY 2019	FY 2018
Electric two-wheelers	126,000	54,800
Electric three-wheelers	630,000	NA
Electric passenger cars	3,600	1,200

Approach to Future EV Market Estimation

- Based on the average GDP growth of 5.8 percent, the Society of Indian Automobile Manufacturers (SIAM) had predicted the 2026 sales of vehicles in India; and
- Likely future market for EVs in India.[36]

Table 5: 2026 sales of vehicles in India

2016-17 Revised Classification as per NITI Aayog	2016-17 Domestic Sales	2026 SIAM Projections (Min.)	2026 SIAM Projections (Max.)	2026 SIAM Projections (Median)
Passenger vehicles- personal	2,132,709	5,170,000	7,370,000	6,270,000
Passenger vehicles -commercial/ fleet	914,018	4,230,000	6,030,000	5,130,000
Commercial vehicles- goods	616,106	1,700,000	3,315,000	2,507,500
Commercial vehicles- passenger	98,126	300,000	585,000	442,500
Three-wheelers	511,658	1,200,000	1,500,000	1,350,000
Two-wheelers	17,589,511	50,600,000	55,600,000	53,100,000
Overall vehicles	**21,862,128**	**63,200,000**	**74,400,000**	**68,800,000**

34 Innovation Norway,. India EV Story Emerging Opportunities.
35 Manda, Srinath, et al. Future Trends in Indian Mobility.
36 Innovation Norway, India EV Story Emerging Opportunities.

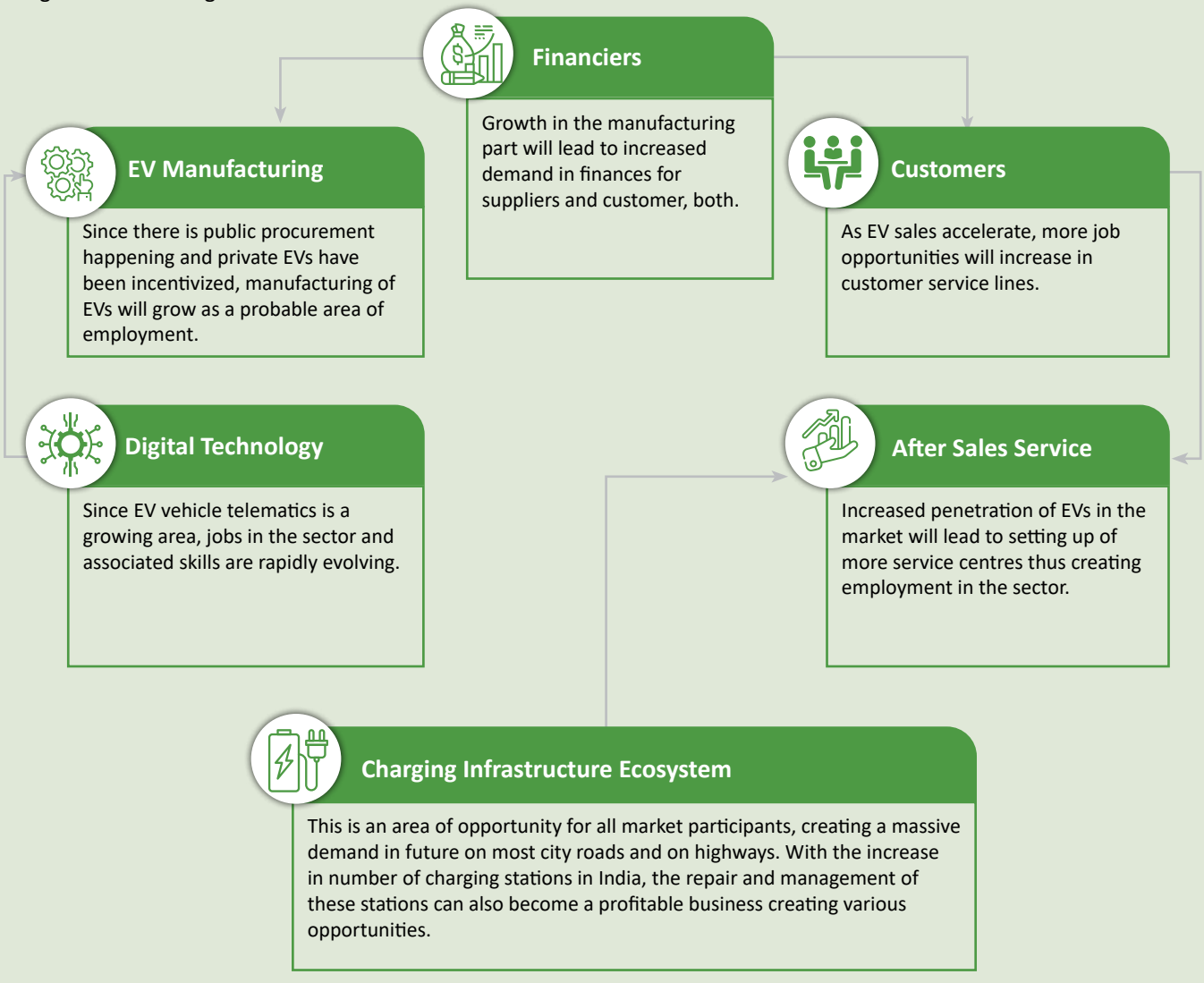
Table 6: Likely future market for EVs in India

	SIAM Data	Feedback Estimate	Feedback Projection	
2016-17 Revised Classification as per NITI Aayog Classification	2016-17 Domestic Sales (all types)	2016-17 Domestic Sales (only EVs)	2026 Business As Usual (BAU)	2026 Transformative
Passenger vehicles - personal	2,132,709	2,000	31,350	1,254,000
Passenger vehicles -commercial/ fleet	914,018		102,600	3,078,000
Commercial vehicles - goods	616,106	-	-	-
Commercial vehicles- passenger	98,126	20	2,213	265,500
Three-wheelers	511,658	50	27,000	675,000
Two-wheelers	17,589,511	22,000	1,062,000	10,620,000
Overall vehicles	**21,862,128**	**24,070**	**1,225,163**	**15,892,500**

Mapping Potential Job Areas

Significant job opportunities have been mapped to the different part of the value chain as depicted in Figure 6.

Figure 6: Potential growth areas



Other Opportunity Areas for Growth

a. Electric car battery shop
   - The current battery market in India is governed by lead acid batteries. Most of the lithium ion batteries are being imported from other countries such as China. Since 2019, companies have started setting up lithium ion battery assembling plants in India. The components are being exported and the assembling and packaging is taking place in India. At present, the market is ruled by two key large players: Exide Industries and Amara Raja Industries.[37] With the growth in the number of EVs in the market, setting up of EV battery sales shop would be a profitable business.[38]

b. Electric car servicing garage
   - The design complexity in EVs is low compared to ICE vehicles because EVs have only 20 moving parts compared with nearly 2,000 in an ICE. Since the parts in an EV are different from a conventional ICE vehicle, electric car service is also entirely different. Thus, opening of servicing garages can lead to a potential business opportunity in the EV market.[39]

c. Mechatronics
   - The transition to EVs and hybrid EVs will propel the demand for specialists in mechatronic engineering. From electrical motor control to battery and power management, sensor-making to computational skills, there will be demand for people specializing in the developing sector.

d. Artificial intelligence (AI) and machine learning (ML):
   - With the automotive industry focusing more on automation and connectedness, AI and ML will be playing a vital role in vehicles and factories of the future. It will be important for employees to understand and implement AI in R&D, production, supply chains and services.[40]

UNDERSTANDING THE JOB PROJECTION MODEL

Employment Projections in the EV Sector

According to estimates from NITI Aayog, employment will increase from 500,000 to 850,000 by 2030 in the EV segment. Since it is a part of the larger auto industry, job projections for rest of the value chain are expected to be similar to the auto industry projections. Powertrain manufacturing is the main segment that is viewed as a significant growth area specifically with regard to domestic assembly of battery packs. The Council on Energy, Environment and Water along with Shakti Sustainable Energy Foundation has published a report explaining a model that estimates jobs in the EV sector by considering two different scenarios.

Case 1: 30 percent electric car sales in 2030 (EV30)

- Within the EV30 scenario, two sub scenarios with different levels of indigenization of powertrain components have been developed so as to determine the economic implications of EVs on the auto industry;
- The current level of indigenization of powertrain components for ICE cars is 90 percent. However, achieving the same level for electric powertrain components is possible only through an aggressive push to the ecosystem through development of infrastructure. Therefore, one scenario with 90 percent indigenization (high indigenization - EV30-High) and another one with 50 percent indigenization (low indigenization - EV30-Low) of electric car powertrain components have been considered (Figure 7);
- Indigenization indicated here pertains to only electric drive components;
- In all the scenarios, it has been assumed that battery manufacturing in India in 2030 will be limited to battery pack assembly, and there will be no domestic cell manufacturing; and
- Depending upon the level of indigenization of electric car powertrains (excluding battery pack), it is expected that 401,388 to 415,369 jobs will be supported in 2030 (Figure 8). This is 23-25 percent fewer jobs than in Business as Usual (BAU) scenario.

37 Innovation Norway, India EV Story Emerging Opportunities,
38 https://emobilityplus.com/2019/09/30/what-are-the-new-business-opportunities-in-indias-ev-charging-industry/
39 Ibid.
40 PWC, Indian automotive sector.

Figure 7: Electric car penetration scenarios in 2030

Scenarios	ICE car share of sales	Electric car share of sales	Indigenization level
Business as usual	98%	2%	
EV transition-high indigenization scenario (EV30-high)	70%	30%	
EV transition-low indigenization scenario (EV30-high)	70%	30%	

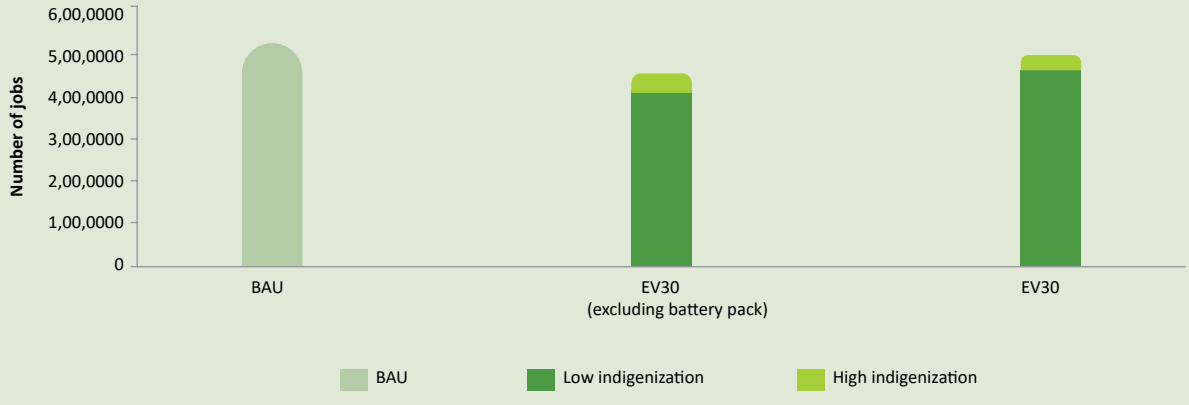
ICE car powertrain Electric car powertrain Battery pack

Case 2: BAU

- In the BAU scenario, it is assumed that there is no rigorous effort to indigenize electric car component manufacturing, and no demand-side incentives to promote uptake of EVs in India. This would result in electric cars growing at a 2 percent share in the total domestic car sales in 2030. In this case, an estimated number of 538,644 jobs will be supported in 2030 through the manufacturing of powertrain components for both ICE and electric cars, excluding battery packs (Figure 8); and
- In 2018, the total number of jobs in ICE car powertrain manufacturing is 185,333 in 2018 (calculation based on equation 2 in the Annexure). In 2030 (with 30 percent electric car penetration), the total number of jobs will increase to 383,913 indicating an overall increase of 7 percent between 2018 to 2030.

While, on the one hand, there will be fewer jobs in the manufacturing of powertrains, new jobs can be created by indigenizing the assembly of battery packs. Thus, indigenization of battery pack assembly in the EV30 scenario will lead to the creation of about 11,019 to 14,167 additional jobs. This reduces the overall gap in manufacturing jobs between EV30 and BAU to 20–24 percent from 23–25 percent.

Figure 8: Jobs supported by manufacturing ICE and electric car powertrains will be fewer under the EV30 scenarios in 2030



Green Transport Job Creation Potential

a. Non-motorized Transport

- Assuming usage of 20 bicycles per 1,000 population for 20 percent of the population.

Figure 9: Job creation potential for non- motorized transport

b. Electric Vehicles

- Assuming 10 percent adoption

Figure 10: Job creation potential for EVs

CHALLENGES TO THE GROWTH OF JOBS IN THE SECTOR

1. **Challenges identified in development of the EV sector**
   a. Lack of well-developed charging infrastructure:
      - In the EVSE ecosystem, the primary barrier is the lack of reliable, accessible and affordable charging infrastructure[41] along with high cost of setting up of the charging station;
      - Limited land availability and higher expectations of rent pose a hurdle;
      - Poor availability of fast chargers, lack of local supply chain for EVSE and the fact that imported chargers are not reliable and are incompatible with Indian weather conditions also creates hindrance[42] ; and
      - Longer charging times of EVs when rapid chargers are not available is another matter of concern.

   b. High upfront cost:
      - Another issue that poses as a challenge is the high upfront cost of EVs due to low performance and high cost of batteries.

   c. Lack of EV models:
      - Current EV products are not suitable for urban freight and logistics with respect to payload capacity and speed. Further, due to the unavailability of EVs more suitable for fleet services, lower seating capacity is being seen as an issue in the current models.

   d. Regulatory challenges in the development of EV sector:
      - Lack of a clear policy on EV deployment and inadequate clarity in the legislative framework; and
      - Since EVs are dependent upon upstream policies (subsidies) for now, investors are apprehensive about their viability.[43]

2. **Women-specific Challenges**
   a. Discrimination and stereotyping:
      - Social belief that women are unfit/less fit for roles demanded by the specific transport profession;
      - Patriarchal mindset making women unfit for jobs in a male-dominated organizational environment. Pre-conceived notions on lack of opportunities for women in the transport sector. Perception that the automobile industry includes heavy and manual work, which is dirty and greasy, unfit for women; and
      - Gender discrimination in terms of wages at the workplace.

   b. Labour conditions:
      - One key concern restricting female participation in the transport sector is safety;
      - Another major barrier becomes sexual harassment or violence against women by colleagues, clients or managers;
      - Working conditions that include inflexible working times, little schedule control, atypical shifts and changing working locations; and
      - Lack of separate toilets, dressing rooms, appropriate medical facilities and even uniforms for men and women as well as low level of hygiene in working areas.

   c. Corporate/public policies:
      - Lack of corporate policies which account for fair recruitment of men and women or that facilitate women in the workplace along with the absence of role models for women.

   d. Lack of entrepreneurial initiatives:
      - The transition towards the EV start-up ecosystem requires innovation along with push from the government in terms of subsidies and incentives. There are a number of EV start-ups that have ventured into areas of two-wheeler manufacturing, battery technology, vehicle diagnostics and analytics, etc., but to accelerate the involvement of women in these entrepreneurial roles, a great deal of investment in terms of funding and training opportunities is still the need of the hour;
      - One such start-up is explained here: A recent development in the EV ecosystem in the country is the growing popularity of

41 EY, 2019. Technical study of Electric Vehicles and Charging Infrastructure.
42 Soman, Abhinav, et al., 2019. India's Electric Vehicle Transition.
43 Ibid.

hybrid retrofit kits. Based on regenerative braking, these kits can convert fuel-based vehicles into hybrid, offering both emission and cost savings to consumers. Since they dramatically reduce tailpipe emissions, these kits are grid-independent and based on the vehicle model and can be usually fitted in four to six hours. Their benefits have been well-recognized and the market for these kits is slowly expanding. The domain offers employment as well as entrepreneurial opportunities for women. Unskilled and semi-skilled women may be trained to become retrofit technicians and technical training on retrofit designing, battery management systems, motor controllers, etc., may be conducted for skilled women interested in this sector;

- Lack of training opportunities for women, technical capability and capacity and skill development to gain the relevant skills required for the specific line of work; and
- Financing education and training to acquire the relevant skills.

3. Skill gaps

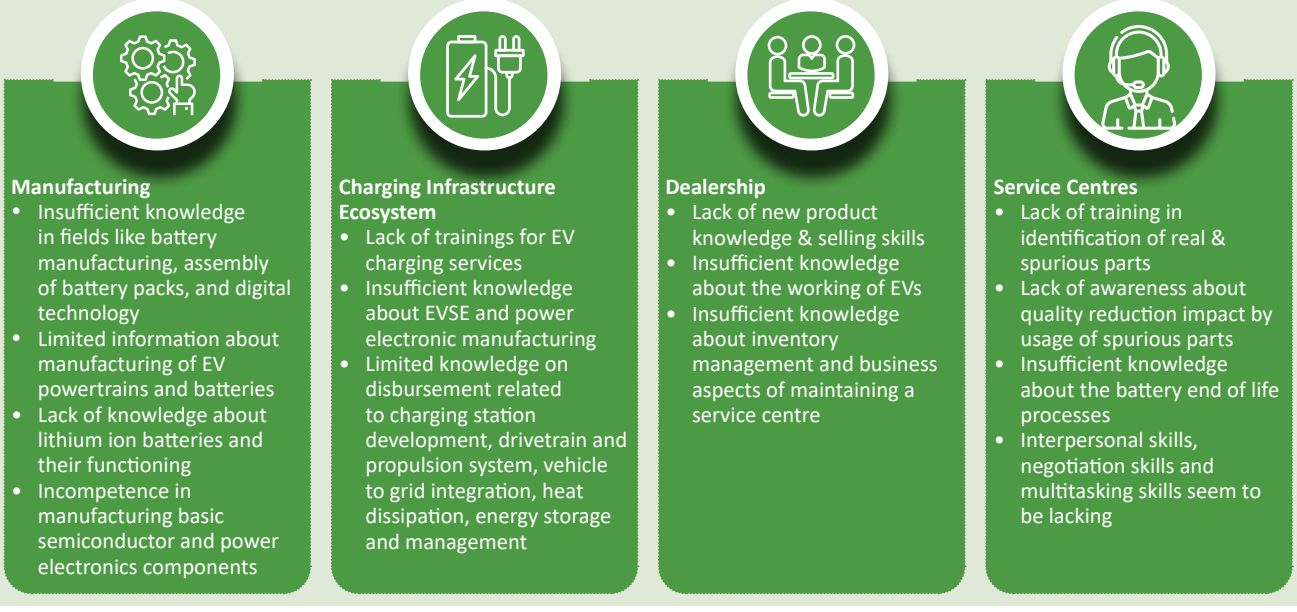
Skills or knowledge around particular segments in the value chain is missing.[44] Some of the broader skill gaps thus identified are mentioned in Figure 11.[45]

Impact of COVID-19 on the EV Sector

The EV industry that heavily relies on countries such as China, Korea and Japan for the import of cells, battery and other electronic components and sensors may experience a period of prolonged slowdown. The probability of forming technology partnerships for sensor, electronics and telematics will also come up, according to Okinawa MD and Founder. Collaboration of Indian and international players for setting up of a manufacturing base in the country could also be explored. Companies having localized supply chains will see limited impact compared to those that were importing completely knocked down goods from China.[46] Since the battery manufacturing market in India is at a very nascent stage, most companies will have no other option but to import these cells from countries such as China, Japan, Korea. To overcome the challenge, many battery manufacturing firms have started working on development of Li-ion battery technologies indigenously for EVs. Also, EV players in the country need to even up the supply chain which is the sole requirement now.[47]

According to the Society of Manufacturers of Electric Vehicles (SMEV) Director General, FY-21 will be a defining year for all EV segments despite the COVID-19 pandemic. A switch from crowded public transport to electric two-wheelers is also expected as the cost of commuting is nearly the same.[48]

Figure 11: Skill gaps in the EV sector



44 National Skill Development Corporation, Human Resource and Skill Requirement in the Auto and Auto Components Sector (2013-17, 2017-22).
45 Soman, Abinav, et al., 2019. India's Electric Vehicle Transition Impact on Auto Industry and Building the EV Ecosystem.
46 https://auto.economictimes.indiatimes.com/news/industry/COVID-19-impact-how-ev-industry-is-coping-with-the-lockdown/74869368
47 https://inc42.com/buzz/startups-COVID19-ev-players-focus-on-make-in-india-to-overcome-supply-chain-issues/
48 https://www.bloombergquint.com/business/electric-vehicle-sales-in-india-up-20-in-2019-20-industry-body-says

TRAININGS OFFERED IN THE SECTOR

- Within the EV sector, specific trainings have been organized by certain organizations in order to impart the necessary skills and bridge the skill gaps. These trainings help building the conceptual understanding of the basics in engineering and branches of science related to EV technology and industry, hence offering job opportunities and career growth options in EV sector.

Table 7: List of training institutes

S. No	Name of the Institute	Description	Number of Courses Available	Courses Offered
1	Academy of EV Technology	Its mission is to meet the needs of the emerging EV industry by providing high value services while fostering clean, sustainable and healthy transportation to the community at large Monthly training calendar can be accessed at: http://aevt.org/admission/training-calendar.php	5	**Entrepreneurs:** • Advance Certificate EV Technology & Business Management - Techno Commercial Training for Business owners • Certificate EV Battery Pack, e-Mobility Technology (Corporate Training) **General:** • Electric Vehicle Technology Advance Certificate Course • Certificate EV Charging Station Installer Electric Bike Technician (Electric Bike Mechanics Training Course) • Vocational Training in e-Mobility
2	Azad Foundation	Azad Foundation provides livelihoods with dignity for resource-poor women living in urban areas in India. The foundation, through its programmes, provides training and employment opportunities to women from underprivileged backgrounds Enrolment rate: 2015-16: 436 (Kolkata, Jaipur, Indore & Delhi) 2016-17: 582 (Kolkata, Jaipur, Indore, Delhi, Ahmedabad & Bengaluru) Can be accessed at: http://azadfoundation.com/about-us/reports/	1	• Women on Wheels – Technical modules – Self-development modules – Empowerment module
3	VIDYA	VIDYA is a non-profit NGO that works towards empowering and transforming the lives of people through education. The VIDYA Bhagini Women Empowerment Centre at Mali Foundation in Bengaluru is focused on training women by imparting vocational training to them on various skills including driving Can be accessed at: https://vidya-india.org/about-us/programs/bangalore/	1	• VIDYA Bhagini Women Empowerment Training Programme – Driving course in tie-up with Bimal

S. No	Name of the Institute	Description	Number of Courses Available	Courses Offered
4	CADD Centre	CADD centre offers courses on theoretical knowledge and practical training in design, simulation and analysis of parts that go into making a complete battery system for EVs Can be accessed at: https://ev.cad-dcentre.com/training_calendar.php	4	• EV technology and operations • Battery technologies & design • EV power train design • EV battery design
5	Verzeo	Verzeo is an upskilling e-learning platform headquartered in Bengaluru. It imparts technical knowledge and skills related to hybrid and electric vehicle systems and their components Enrolment rate: 51,520 + students enrolled Can be accessed at: https://www.verzeo.in/	1	• Hybrid and electric vehicle internship course
6	Autobot India	Autobot India provides specialized and customized training and development programmes such as EV design, prototype and testing, electric and hybrid vehicle: eDrives, powertrain and lithium battery technology, li-ion battery: technology, safety and BMS, etc. Can be accessed at: https://autobotindia.com/	4	• Electric vehicle design and development • EV- energy storage system • EV bootcamp • Battery technology, safety & assembly process
7	Advance Electrical Design and Engineering Institute (AEDEI)	Provides training in design of EVs, light and heavy EVs and hybrid vehicles. Can be accessed at: https://www.advanceelectricaldesign.com/regular-courses	2	• Hybrid EV design and EV charging station design training • Online EV charging station design training
8	National Power Training Institute (NPTI)	Provides a comprehensive overview of the e-mobility and charging infrastructure for working professional who wish to upgrade their skills Can be accessed at: http://npti.gov.in/training-academic-calender	1	• e-Mobility and charging infrastructure

5.1 SOME EXISTING TRENDS IN THE SECTOR

a) Indian experience

- Honda has taken up an initiative to extract oxide containing rare earth metals such as nickel from old batteries since 2013. It can extract rare earth metals with 99 percent purity through the molten salt electrolysis technology. Up to 80 percent of the metals found in a battery can be extracted and reused on the electrodes of other batteries[49].
- National Thermal Power Corporation, a key player in setting up of EV charging infrastructure in India, has installed its first stations at its offices in Delhi and Noida and these are only specific to Mahindra vehicles as of now.[50]

b) International experience

- 4R Energy Corporation is a joint venture company established by Nissan and Sumitomo together to foster battery recycling operations in Japan. Because of the strict laws for older vehicles, the recycling process has become economically viable. The company came up with a system that measures battery performance as a whole and that of individual modules, assessing components and sub-assemblies that can be reused and should be recycled. Components with remaining energy capacity can be reused and reassembled into refabricated battery packs, some of which will be offered as lower-cost replacement batteries for older electric car.[51]
- BMW, in 2016, came up with a stationary energy storage system solution integrating used EV batteries. Also, BMW has constructed a storage facility incorporating 2,600 battery modules from over 100 EVs for a total power capacity of 2 megawatt and a storage capacity of 2.8-megawatt hour. This is done in alliance with BOSCH and Vattenfall. The major function of the system is to stabilize the grid and reduce the impact of peak demand. All these approaches have resulted in extension of battery life for owners.[52]

c) Key private sector initiatives

- Maruti Suzuki partnered with Denso and Toshiba to set up a lithium-Ion battery manufacturing plant in Gujarat in September 2017 at a total investment of INR 17 billion.
- In early 2018, Maruti Suzuki, in collaboration with Toyota, aimed to produce as many as 35,000 electric cars annually in India during 2020–21. Also, in May 2018, the company declared an investment of US$ 14.5 billion in its R&D sector for the EV programme.
- In 2018, Renault India announced that it had placed orders for electric motors and transmission with Rico Auto Industries and was working on developing EVs at its Chennai plant.[53]

49 Bhattacharjya, Souvik, et al., 2018. Towards Resource Efficient Electric Vehicle Sector in India.
50 Innovation Norway, India EV Story Emerging Opportunities.
51 Bhattacharjya, Souvik, et al., 2018. Towards Resource Efficient Electric Vehicle Sector in India.
52 Ibid
53 Manda, Srinath, et al, Future Trends in Indian Mobility.

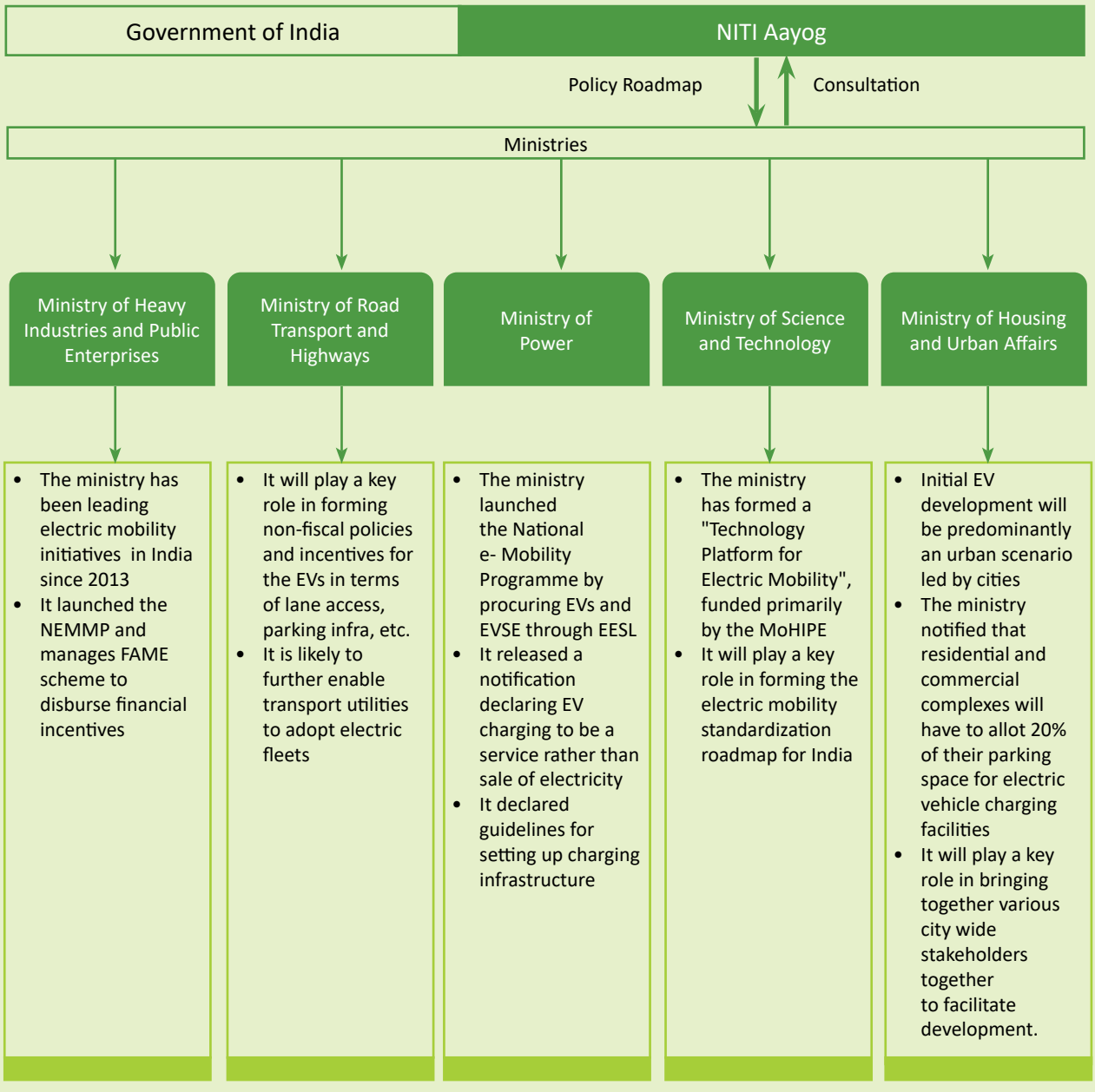
3.

Policy and Regulatory Frameworks

OVERVIEW OF POLITICAL STRUCTURE INVOLVED IN EV POLICY PLANNING

The Ministry of Heavy Industries and Public Enterprises (MoHIPE) launched the National Electric Mobility Mission Plan (NEMMP) in 2013 and FAME India in 2015. Over the years, while identifying cross-sectoral complex linkages of electric mobility and achieving multi-stakeholder development, NITI Aayog was authorized to anchor and coordinate the electric mobility efforts in India.[54]

Figure 12: Overview of political structure involved in EV policy planning



54 EY, 2019. Technical Study of Electric Vehicles and Charging Infrastructure

POLICIES AT THE NATIONAL LEVEL

To develop a future roadmap for green growth of the transport sector in India, the Ministry of Urban Development and Ministry of Road Transport and Highways have launched many policies to make transport green.

Table 8: Policies at the national level

Green Urban Transport Scheme
• The Green Urban Transport Scheme launched by the Ministry of Urban Development with Government of India's assistance of INR 250 billion is aimed at lowering the carbon footprint along with development and improvement of a climate-friendly transport system in urban areas across the country. • The scheme will help provide a sustainable framework for funding urban mobility projects with minimum recourse to budgetary support by encouraging innovative financing of projects.[55]
Green Urban Mobility Scheme
• Green Urban Mobility Scheme was launched by the Government of India on 16 March 2017 in 103 cities so as to promote the use of hybrid/electric vehicles and non-fossil fuels, among others, for public transport. The main aim of the scheme is to promote the use of green public transport.[56]
NEMMP 2020
• NEMMP was launched by MoHIPE in 2013 to achieve global leadership in manufacturing of EVs. • The government is planning to use the following mechanisms/policies in order to increase EV use in India under this scheme: - NEMMP targets 400,000 passenger battery electric cars thus enabling fuel savings worth INR 120 million along with a decrease in carbon dioxide emissions. The total investment required will be INR 200– 230 billion (approximately US$ 3 billion); - Legislations to allow usage of EVs in various areas, if not already allowed; - Use of the legislation framework and regulations aimed at setting safety regulations, emission regulations, vehicle performance standards, charging infrastructure standards, etc.; - Fiscal policy measures: Trade-related policies for shaping the market, imports and exports; - Manufacturing policies aimed at encouraging investments and specific policies aimed at incentivizing manufacturing and early adoption of EVs through demand creation initiatives; and - Schemes and pilot projects for facilitating infrastructure creation and policy for facilitating R&D.[57]
FAME India
• As part of the NEMMP 2020, FAME India scheme with the objective to promote manufacturing of electric and hybrid vehicle technology and ensure its sustainable growth was formulated by the Department of Heavy Industry in 2015. • The first phase of the scheme was implemented through four focus areas: demand creation, technology platform, pilot project and charging infrastructure. • In the first phase, about 278,000 EVs were supported with a total demand incentive of INR 3,430 million. In addition, 465 buses were sanctioned to various cities/states under this scheme.[58] • The second phase of the FAME scheme was approved for a period of three years starting from 1 April 2019 with an amount of INR 100 billion. • The focus is to create demand for which the government is supporting 7,000 e-buses, 500,000 e-three-wheelers, 55,000 e-four-wheeler passenger cars and 1 million e-two-wheelers. • The vehicles incentivized under this scheme include advanced battery and registered vehicles. The scheme will be applicable mainly to vehicles used for public transport or those registered for commercial purposes in e-three-wheelers, e-four-wheeler and e-bus segments. Privately owned registered e-two-wheelers are also covered under the scheme as a mass segment.[59]

55 Green Insights, 2017.
56 https://www.bankexamstoday.com/2017/10/green-urban-mobility-scheme-key.html
57 Innovation Norway, India EV Story Emerging Opportunities.
58 https://pib.gov.in/newsite/PrintRelease.aspx?relid=191377
59 https://fame2.heavyindustry.gov.in/content/english/1_1_AboutUs.aspx

POLICIES AND INITIATIVES AT THE STATE LEVEL

Delhi

- Delhi reported the sales of 73 units according to the FAME India report for February 2019. Also, Delhi was among the top states to report the highest four-wheeler EV sales in February, i.e., 50 units.[60]

Delhi- Electric Vehicle Policy 2020[61]

- Aims at 25 percent of new vehicle registrations to be electric by 2024;
- Proposes a feebate to fund a high proportion of the incentives;
- **Provides for both fiscal and non-fiscal incentives.** In order to address the high-upfront cost of EVs (compared with internal combustion engine [ICE] vehicles), the policy provides demand incentives for purchasing electric two-wheelers, cars, auto-rickshaws, e-rickshaws, e-carts and goods carriers (L5N and N1 vehicles), in addition to the incentives provided under the FAME II scheme.
- Set up of "State Electric Vehicle Board" along with 200 charging stations in one year, so that the charging stations are within 3 km radius
- Encourages the reuse and recycling of EV batteries that have reached the end of their lives;
- By making e-rickshaws available at a subsidized rate of INR 30,000, Delhi has created the largest network of e-rickshaws in the country, promoting clean last mile connectivity; and
- Creating Jobs in the EV supply chain- aims to promote about 5 Lakh EVs in Delhi, such as EV drivers, auto-mechanics, charging station operating staff, etc.

Karnataka

- According to the FAME India report of February 2019, sales of EVs in Karnataka were 384. The state was among the top states in India, along with Haryana and Maharashtra that reported the highest EV sales. Karnataka was also among the top states to report the highest four-wheeler and two- wheeler EV sales: 45 and 339 units, respectively, in February;[64] and
- Incremental demand is projected in Karnataka 2012-2022,[65] for minimally and semi-skilled labour (Table 9).

Electric Vehicles Manufacturing Policy 2018, Karnataka

- 100 percent of three- and four-wheelers for moving goods will be encouraged to transition to electric by 2030;
- Incentives will be given for the first 100 fast chargers;
- Start-ups will be encouraged to develop business models for supporting economic applications for EVs[66];
- The Government of Karnataka plans to buy 640 EVs for public transportation of which 40 will be buses, 100 cars, and 500 three-wheelers [67]; and
- The Cycle Day Initiative, a government-citizen campaign, aims to make cycling mainstream and spread awareness about the importance of safe streets for non-motorized transport users.

Maharashtra

- According to FAME India report of February 2019, Maharashtra reported sale of 155 units of EVs. It was among the top states that reported the highest four-wheeler EV sales of 33 units in February.[68] It reported sales of around 4,865 EV units in 2017-18 according to data from the Society of Manufacturers of Electric Vehicles (SMEV)[53];

Table 9: Incremental demand in Karnataka, 2012 - 2022

Sectors	Minimally Skilled	Semi-skilled
Auto & auto components	5,830	37,893
Transportation, logistics, warehousing & packaging	127,940	371,027
Total	**133,770**	**408,920**

Note: The above data is only for the auto and transport sector.

60 https://electricvehicles.in/electric-vehicles-sales-report-in-india-february-2019/
61 Delhi EV policy's twin boost: Faster EV adoption and improved air quality - RMI India (rmi-india.org)
62 NITI Aayog & Rocky Mountain Institute, 2019. India's Electric Mobility Transformation.
63 https://aamaadmiparty.org/nine-measures-arvind-kejriwals-government-has-taken-to-reduce-air-pollution-in-zdelhi-by-25/
64 https://electricvehicles.in/electric-vehicles-sales-report-in-india-february-2019/
65 National Skill Development Corporation, District-wise Skill Gap Study for the state of Karnataka.
66 NITI Aayog & Rocky Mountain Institute, 2019. India's Electric Mobility Transformation.
67 https://swachhindia.ndtv.com/karnataka-governments-green-push-control-air-pollution-soon-state-will-buy-640-electric-vehicles-16338/
68 https://electricvehicles.in/electric-vehicles-sales-report-in-india-february-2019/
69 https://economictimes.indiatimes.com/news/economy/policy/emphasise-on-evs-frame-policy-to-reduce-total-ownership-cost-economic-survey-2019/articleshow/70070730.cms

- Incremental demand for EVs is anticipated in Maharashtra, 2012-2022[70] (Table 10)

Table 10: Incremental demand in Maharashtra, 2012 - 2022

Sectors	2012-17	2018-22	2012-22
Transportation, logistics, warehousing and packaging	378,925	429,549	808,474
Auto and auto component	138,976	216,061	355,038
Total	**517,901**	**645,610**	**1,163,512**

Note: The above data is only for the auto and transport sector.

- Skill-wise Incremental demand in Maharashtra, 2012-2022[71], is shown in Table 11.

Table 11: Skill-wise Incremental demand in Maharashtra, 2012-2022

Sectors	Minimally Skilled	Semi- Skilled
Auto & Auto Components	45,877	190,084
Transportation & Logistics	177,048	396,851
Total	**222,925**	**586,935**

Note: The above data is only for the auto and transport sector.

Electric Vehicle & Related Infrastructure Policy 2018, Maharashtra

- Targets to increase the number of EV registrations in Maharashtra to 500,000;
- Aims to generate an investment of INR 250 billion for the manufacturing of EVs;
- Create jobs for 100,000 people[72];
- Proposes a 15 percent subsidy to the first 100,000 EV owners when registered in the state;
- Proposes a maximum subsidy of INR 1 million (Euro 12,560) per charging station to be awarded to 250 stations in the state[73]; and
- Proposes an annual tax of INR 5,000 on all commercial and private vehicles that are 15 years old or more. The funds generated would be used for implementing air pollution control measures[74].

Haryana

- According to the FAME India report, as of February 2019, sale of EVs in Haryana was 155. It was among the top states in India to report the highest EV sales. Haryana was also among the top states that reported the highest three-wheeler EV sales (18 units) in February[75];
- Based on SMEV data, in 2017-18, the EV sales were reported to be 6,307 units[76];
- Skill development opportunities (2012-22)[77] are shown in Table 12; and

Table 12: Skill development opportunities (2012-22)

Industries	Incremental Manpower Requirement 2012-17			Incremental Manpower Requirement 2017-22		
	Semi-Skilled	Minimally Skilled	Total	Semi-Skilled	Minimally Skilled	Total
Auto & Auto Components	12,935	16,174	29,109	14,219	17,781	32,000
Transportation & Logistics	148,094	176,194	324,288	185,530	220,732	406,262
Total	**161,029**	**192,368**	**353,397**	**199,749**	**238,513**	**438,262**

Nate: The above data is only for the auto and transport sector.

70 National Skill Development Corporation, District-wise Skill Gap Study for the state of Karnataka.
71 Ibid.
72 NITI Aayog & Rocky Mountain Institute, 2019. India's Electric Mobility Transformation.
73 Bhattacharjya, Souvik, et al., 2018. Towards Resource Efficient Electric Vehicle Sector in India.
74 https://www.downtoearth.org.in/news/maharashtra-proposes-green-cess-on-old-vehicles-1118
75 https://electricvehicles.in/electric-vehicles-sales-report-in-india-february-2019/
76 https://economictimes.indiatimes.com/news/economy/policy/emphasise-on-evs-frame-policy-to-reduce-total-ownership-cost-economic-survey-2019/articleshow/70070730.cms
77 National Skill Development Corporation, Presentation for the State of Haryana (2012-17, 2017-22).

- In order to tackle last-mile connectivity problems in Gurugram, aggregated cabs major Uber launched its bike-sharing service, Uber-MOTO. To streamline Gurugram's mobility, there is need for private players to step up and help the government. In the past, Gurugram has hosted biking-focused initiatives, including Raahgiri and car-free days.[78]

Telangana

- Telangana's EV policy, in its final stages of release, builds on ambitious goals that include 100 percent electrification of public transport and shared mobility services by 2030 and creation of 50,000 jobs in the state by 2022.[79]

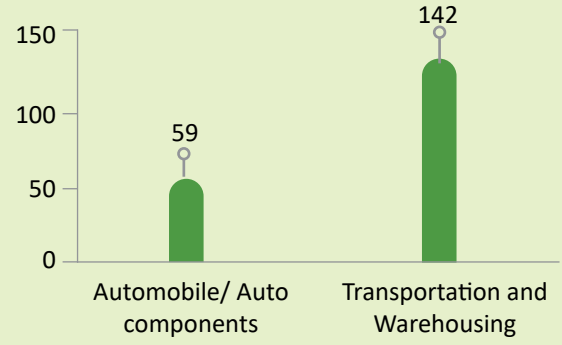
Electric Vehicle Policy Draft 2017, Telangana

- Telangana State Transport Corporation has set a target of 100 percent electric buses by 2030 for intracity, intercity and interstate transport; and
- The Government of Telangana will set up the first 100 fast charging stations in Greater Hyderabad Municipal Corporation and other cities in a phased manner.[80]

Uttarakhand

- The total number of EV sales for Uttarakhand was 37 units according to FAME India report for February 2019[81];
- Estimated incremental manpower demand (2012-22)[82] is shown in Figure 13;

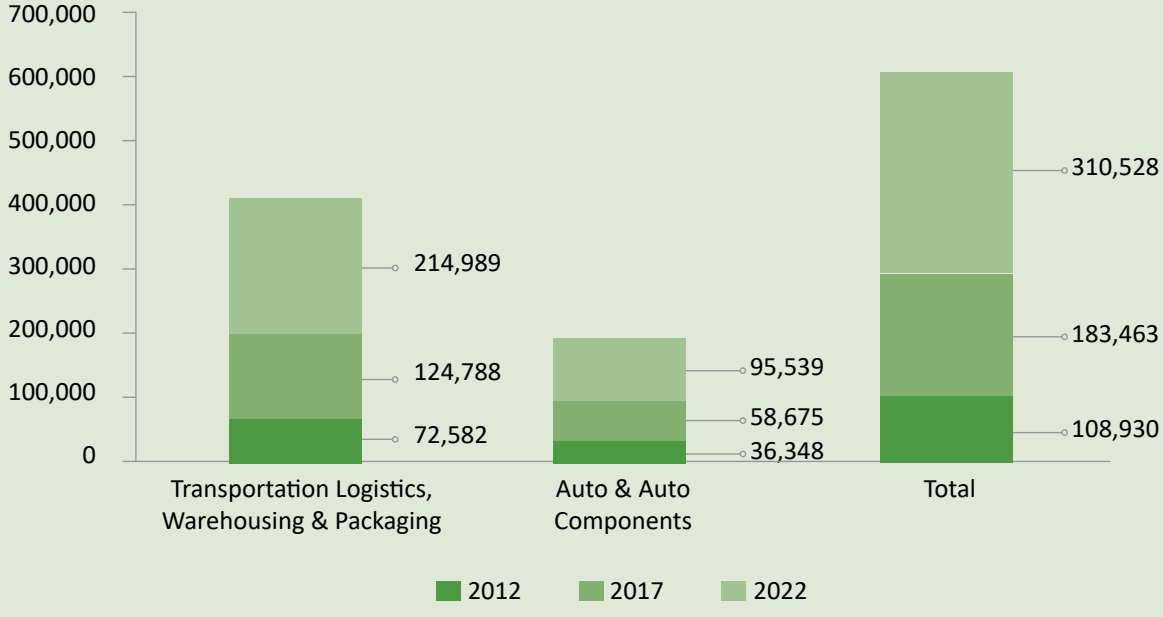
Figure 13: Incremental human resource requirement by industry in 2012-2022 (in 000s)



Note: The above data is only for the auto and transport sector.

- Sector-wise break-up of the total human resource requirement[83] is shown in Figure 14; and

Figure 14: Sector-wise break-up of total human resource requirement



Note: The above data is only for the auto and transport sector.

78 https://yourstory.com/2017/07/thegurugramstory-spotlight-sustainable-mobility-green-homes
79 https://www.nrdc.org/experts/anjali-jaiswal/india-focus-telangana-moves-electric-mobility
80 NITI Aayog & Rocky Mountain Institute, 2019. India's Electric Mobility Transformation.
81 https://electricvehicles.in/electric-vehicles-sales-report-in-india-february-2019/
82 National Skill Development Corporation, Presentation for the state of Uttarakhand (2017, 2022).
83 National Skill Development Corporation, District Wise Skill Gap Study for the State of Uttarakhand (2017, 2022).

- Skill level-wise break up for growth in the sector is shown in Table 13[84].

Table 13: Skill level wise break up for sector growth

Sector	2017			2022		
	Minimally skilled	Semi-skilled	Total	Minimally skilled	Semi-skilled	Total
Transportation, Logistics, Warehousing & Packaging	23,812	10,698	34,510	27,528	12,368	39,896
Auto & Auto Components	18,972	25,035	44,007	30,891	40,763	71,654
Total	**42,784**	**35,733**	**78,517**	**58,419**	**53,131**	**111,550**

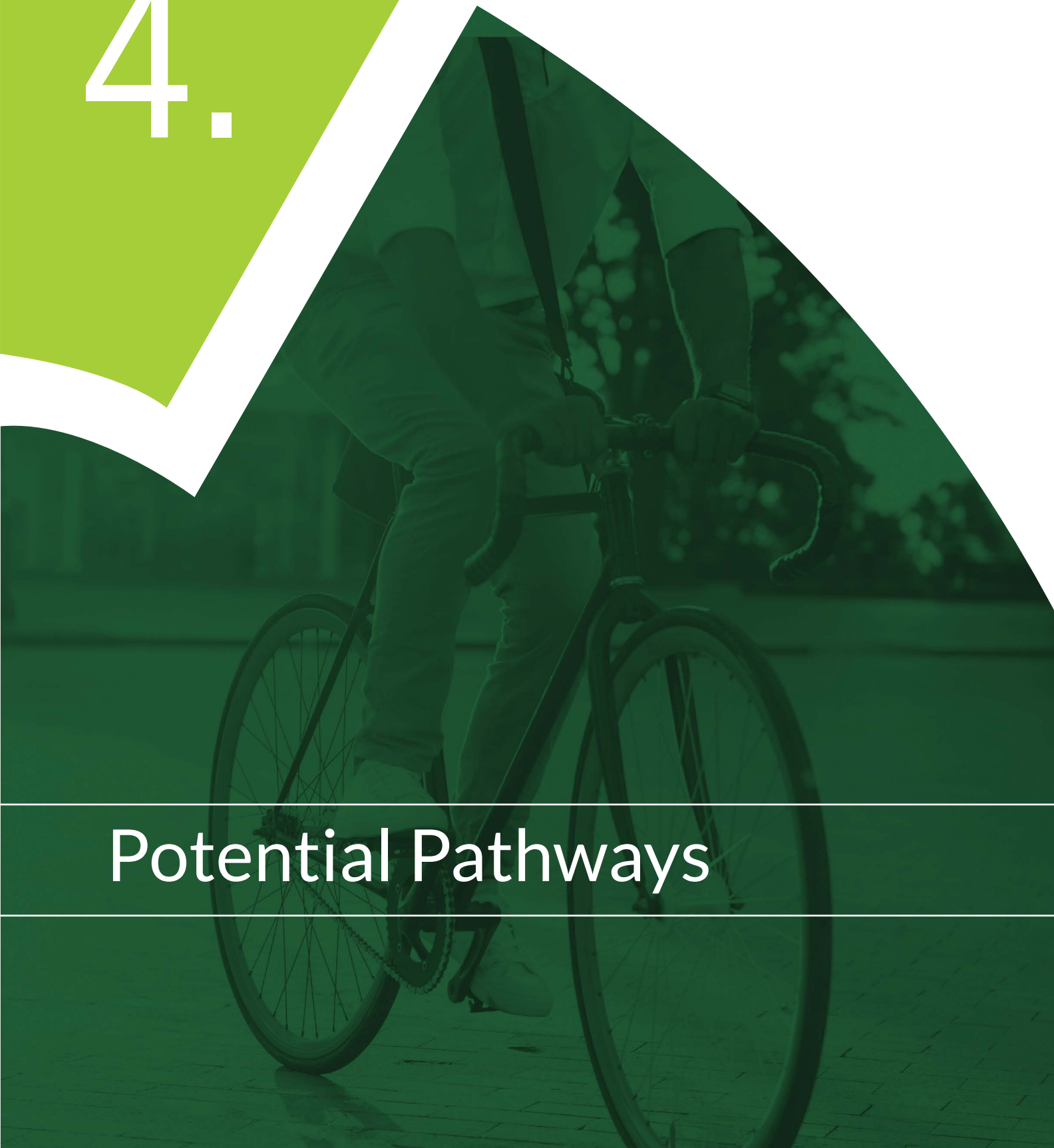
Note: The above data is only for the auto and transport sector.

EV Manufacturing, EV Usage Promotion & Related Services Infrastructure Policy 2018, Uttarakhand

- Aimed at making Uttarakhand a preferred destination for investment in EV manufacturing capacity;
- Special focus on developing green highways in Dehradun, Haridwar, Rishikesh, Haldwani, Rudrapur and Kashipur; and
- Term loans in the range of INR 100 million to INR 500 million will be provided to micro, small and medium enterprises interested in manufacturing EVs.[85]

84 National Skill Development Corporation, District Wise Skill Gap Study for the State of Uttarakhand (2017, 2022).
85 NITI Aayog & Rocky Mountain Institute, 2019. India's Electric Mobility Transformation.

4.



Potential Pathways

The limited role of women in the transport sector is an issue that needs to be addressed. More women mean bringing more talent to the transport sector and a broader view encouraging innovation and moving into the future.

RECOMMENDATIONS TO ENHANCE WOMEN'S PARTICIPATION

Women's skills and perceptions are key to addressing different gender requirements in access to transport and mobility, and responsiveness of transport systems to the needs and preferences of women, including safety and security. Some measures can be taken to escalate the participation of women in the transport sector. These include:

Technical Training to Women in Specific Segments of the EV Value Chain

- **Imparting trainings to semi-skilled and unskilled women** in various parts of the value chain such as operating and maintaining charging stations, battery swapping and battery management systems for EVs;
- **Training to semi-skilled and unskilled women** may be provided in areas of customer service and after-sales services in roles such as showroom host, accessory fitter, sales/service trainer, etc.;
- Increasing female enrollment through higher scholarships and evening classes in training institutes and offering paid internships and conducting training for women as a part of the corporate social responsibility expenditure; and
- **Setting up of training institutes** specifically for women and organising practical training sessions on various areas of the EV ecosystem may also undertaken. For instance, the Women on Wheels programme is one such initiative designed specifically for empowering resource poor women to help them become independent. The programme, developed by Azad Foundation, is aimed at training these women to become professional drivers.

Policy and Financial Support to Women Entrepreneurs in the EV Space

- Introduction of policies for EV enterprises/start-ups owned and run by women to provide them with additional capital subsidy and reduced collateral requirements on loans such as under **Start-up India;**
- Increased lending to local women entrepreneurs in the EV industry and training grants to women start-ups seeking to employ local women can boost their participation in the sector. For example, to mainstream electric mobility in the country, the government has devoted INR 10,000 crore under the **FAME scheme** and 5 percent GST reduction on EVs[91]. Similary, special arrangements can be made specifically for women under these scheme to support EV uptake by them;
- Interest-free loans for the first three years to women buyers and employee provident fund refund to enterprises employing over 40 percent women in workforce will also boost women's participation. A similar policy recommendation was incorporated in **Industrial Investment and Employment Promotion Policy 2017,** which stated that 50 percent of the employer's contribution to the employee provident fund would be reimburesed on direct employment of 100 or more unskilled workers and an additional 10 percent to units generating direct employment of 200 skilled/unskilled workers;
- The **Fund of Funds Scheme,** an initiative under Atmanirbhar Bharat Abhiyan, is one scheme that aims to provide financial assitance to the micro, small and medium sectors by infusing INR 50 billion equity. Women entrepreneurs may be offered additional benefits under this scheme;
- **Pradhan Mantri MUDRA Yojana** is another scheme that supports entrepreneurship undertakings and this can be availed of by women entrepreneurs as well[92]; and
- **Pradhan Mantri Kaushal Vikas Yojana** is a skill development initiative that is aimed at enhancing the employable skills of daily wage earners through training and monetary rewards[93]. This scheme can also be availed of by women entrepreneurs in this field.

91 https://yourstory.com/herstory/2020/06/woman-entrepreneur-ev-charger-make-in-india?utm_pageloadtype=scroll
92 https://www.mudra.org.in/
93 http://pmkvyofficial.org/Index.aspx

4.1 SUGGESTED ACTION PLANS

- In the green transport sector, eco-entrepreneurship as an opportunity may be exploited by both genders. As far as the involvement of women is concerned, there are some models that can boost participation of women in the near future. Some of them are detailed here.

Case Study

After attending a conference in Japan with her husband on the how the future is going to revolve around EVs, Hemalatha, a customer service executive at Wipro InfoTech, decided to set up her own EV manufacturing unit. She founded Ampere Electric in 2007 which manufactures e-cycles, e-scooters, e-trolleys (for carrying load) and special-purpose vehicles for waste management as well as to cater to differently abled persons. Her vision is to serve the rural and semi-urban population, especially women, with affordable transportation alternatives, to offer them last-mile connectivity.[94]

The Coimbatore-based EV start-up received seed funding from Ratan Tata and is majorly focused on indigenizing EV components such as battery, motor, charger and controller. The company's aim is to strengthen the products, and make them faster, better and cheaper.[95]

Ampere is said to be the first company in the country to manufacture its own chargers for EVs. One of its projects is aimed at creating charging infrastructure for the emerging EV industry and is supported by the Technology Development Board, Ministry of Science & Technology, as part of the Make-in-India initiative. Additionally, Ampere's R&D team is also developing an intelligent battery chip ensuring that batteries do not bulge, thereby increasing battery life.

Presently, 30 percent of the company's workforce comprises women. It is committed to generating employment for women with specific focus on hiring female staff in engineering and manufacturing fields from tier 2/3 towns and villages. Hemalatha believes that to encourage women entrepreneurs in the sector, support from Tamil Nadu government in terms of finances and awareness generation will be instrumental. Shaping of appropriate policies and a favourable import-export tax structure, tax subsidies are also required[96].

This model of eco-entrepreneurship is imminently scalable. With concerted efforts from the state governments and mobilization of infrastructure at the local level, more such women entrepreneurs may be encouraged to venture out in this domain.

Ampere's exemplary journey has proved to be an inspiration for a number of women across the nation. Here, we explore more such entrepreneurial avenues for women.

Proposed Initiative 1:

Women entrepreneurs as third-party service providers for last-mile connectivity Business to consumer (B2C) companies in India have set ambitious targets to ensure last-mile delivery for households[87]. This presents a significant opportunity to enhance women's participation in the sector. While women may be hired as delivery executives to increase employment, we look at it as an avenue to kick start the entrepreneurial journey for many. We propose the following business model:

Business Model

B2C firms such as Big Basket, Swiggy, Zomato, etc., engage with women entrepreneurs (owning EVs), to act as 'third party service providers' to take forward the corporate agenda of last-mile delivery.

Objective

The model has twin objectives:

- Increased women's participation in the green transport sector and increased opportunities for women's entrepreneurship in the EV industry; and
- Enhanced EV penetration in the country.

94 https://www.deccanherald.com/content/648589/lure-ev-entrepreneurs-unlikely-places.html
95 https://yourstory.com/2015/08/ampere-electric
96 https://www.thehindu.com/features/metroplus/Motoring/hemalatha-annamalai-of-ampere-vehicles-speaks-on-ratan-tata/article7512249.ece
97 https://inc42.com/datalab/with-slow-demand-for-electric-cars-will-commercial-vehicles-drive-indian-ev-ecosystem/

Table 14: Details of **Proposed Initiative 1**

Stakeholders	Role	Examples
B2C firms	• Engage women entrepreneurs as third-party service providers to advance the agenda of last mile delivery • Firms to enter into partnerships with financial bodies (public and private) to seek subsidized loans for women to purchase electric two- and three-wheelers • Firms to enter into tie-ups with certain OEMs to seek discounted price of EVs for women entrepreneurs wanting to purchase electric two- and three-wheelers • Firms to enter into legal contracts with women (buying electric two- and three-wheelers) to purchase services for last-mile delivery at a fixed rate/or with clearly defined price floor to ensure guarantee of minimum return to women entrepreneurs	• Big basket: Aims to increase EVs to 1,000 vans and 2,000 bikes within the next one year • Swiggy: Piloting EVs in 10 cities • Amazon: Planning to roll out 10,000 EVs by 2025 • Flipkart: Aims to convert 40% of its delivery fleet into EV by March 2020.
Women entrepreneurs	• Women to purchase EVs with loan assistance from funding agencies (contracted by B2C firms) • Women entrepreneurs to guarantee services to B2C firms at the rate defined in the contract • Women entrepreneurs to undertake relevant training on driving and maintenance of these EVs	• Potential women entrepreneurs in DISHA states[82]
Financial bodies/ funding agencies (public/ private)	• Agencies to offer loans to women entrepreneurs at subsidized rates • These bodies should reduce collateral requirements for loans for these women entrepreneurs • Offer additional capital subsidy	• Finance companies such as Bajaj Allianz • Bank loans with low interest rates: SBI Green Car Loan
OEM players	• Corporates to enter into partnerships with B2C firms to offer EVs to women at a discounted rate • Corporates to provide subsidized servicing/ maintenance rates to women entrepreneurs	• Hero Electric • TVS • Okinawa Autotech, etc.
Training partners	• Training institutions to offer training to these women entrepreneurs on driving, operation and maintenance of EVs	• Advance Electrical Design & Engineering Institute • Automotive Skill Development Council • Autobot India, etc.
Multilateral agencies	• Act as facilitator between corporates and local agencies such as government bodies, women's self-help groups and local NGOs to mobilize potential women entrepreneurs in the DISHA states	• UNDP

82 https://www.in.undp.org/content/india/en/home/operations/projects/poverty_reduction/creating-employment-and-entrepreneurship-opportunities-for-women.html

Financial Feasibility of the Model

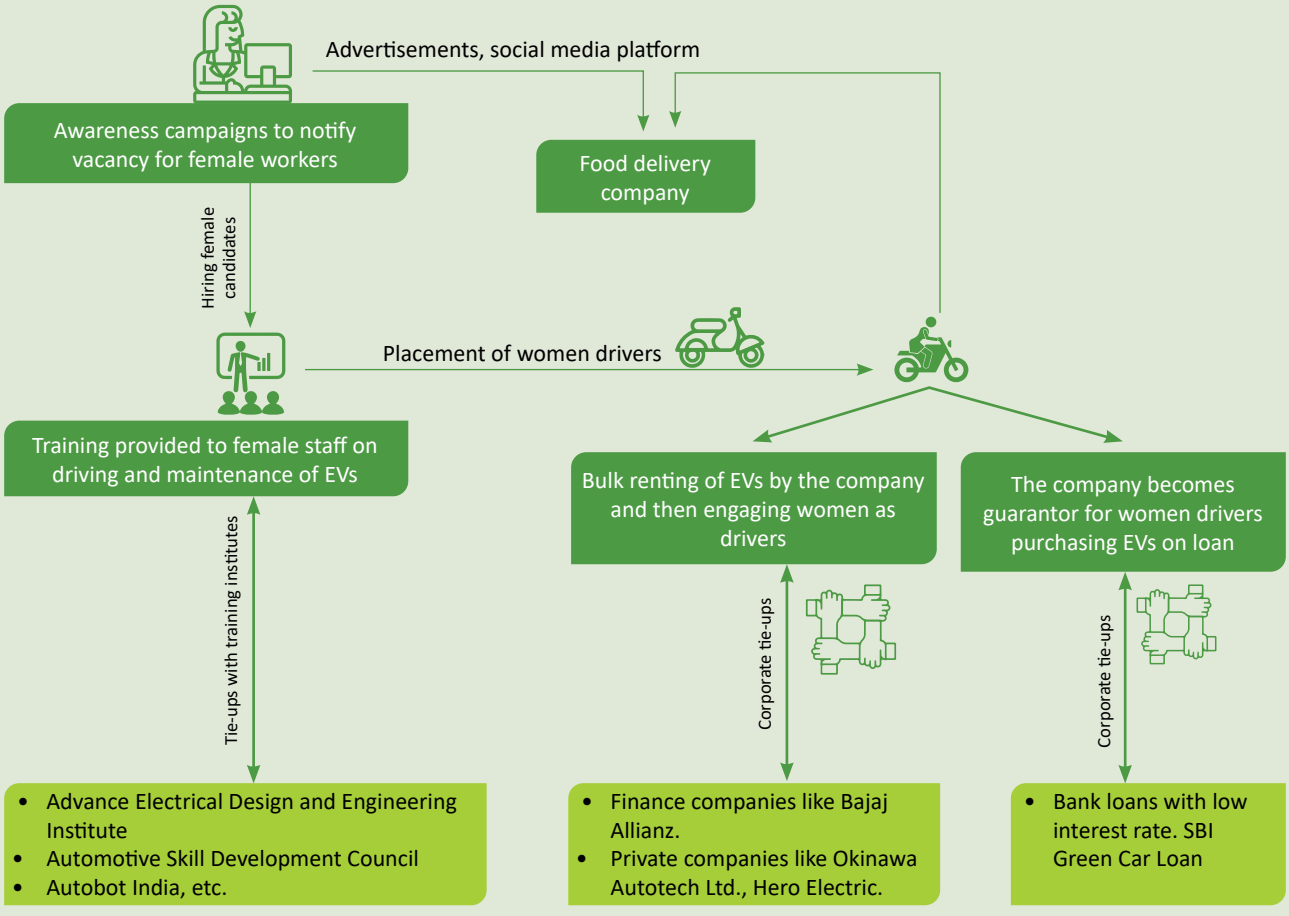
a. Investor Landscape:
   - Financial institutions to offer subsidized or low interest loans to women entrepreneurs basis tie-ups with corporates:
     - Subsidized interest rates/interest free loans
     - Reduced collateral requirements;
   - Corporates can play the role of guarantors for securing vehicle loans for women entrepreneurs; and
   - Government to offer subsidies to women users:
     - Central Goods and Services Tax refund
     - State Goods and Services Tax refund
     - Interest free loans for up to three years.

b. Revenue Stream/Income Generation:
   - Women entrepreneurs purchasing EVs to enter into legally binding contracts with B2C corporates to act as third-party service providers for last-mile delivery; and
   - B2C corporates offer competitive remuneration to cover the following:
     - Monthly instalment/EMIs of the vehicle
     - Monthly charging cost/expenses of the vehicle
     - Economic profit for the women entrepreneurs.

Alternative Model: Employing women as delivery executives

- In case women entrepreneurs are unable to purchase the EVs, B2C corporates may encourage women's participation in the sector by bulk renting of the EVs and then engaging these women applicants as delivery executives. This leads to:
  - Increased women's participation in the sector; and
  - Improved income standards for women.

Figure 15: Business model for last-mile delivery



Proposed Initiative 2:

Women entrepreneurs as EV service station owners

The government's ambitious target of 30 percent EV penetration by the year 2030 creates demand for setting up of EV infrastructure to fuel EV uptake in the country. This offers significant employment opportunities for women entrepreneurs to boost their participation in the sector by setting up of EV service and repair stations.

Business Model

Service stations owned and run by women may be set up in exclusive tie-ups with private OEM players in the electric space to ensure market availability/demand for services.

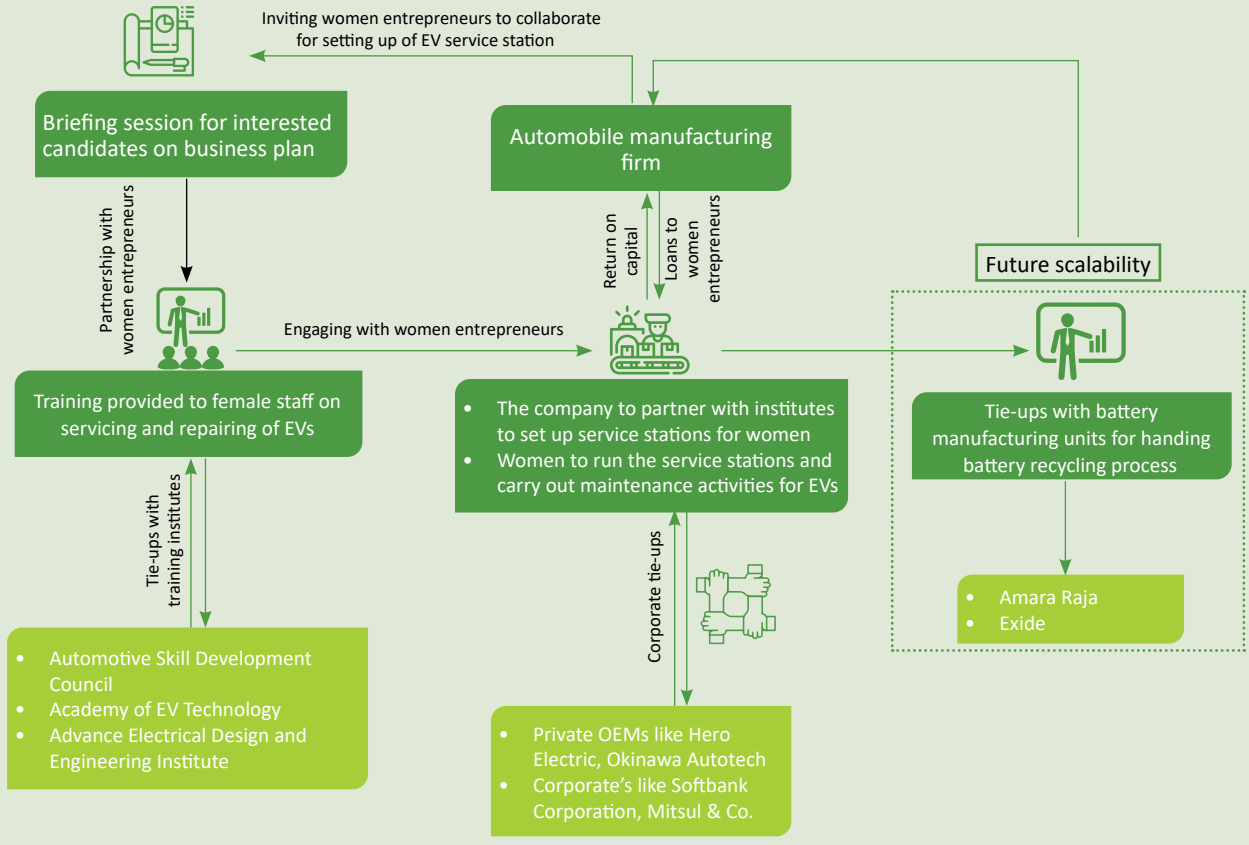
Objective

The model has the twin objectives of scaling infrastructure for growing EV demand by eliminating demand-side blockages and enhancing women's entrepreneurship opportunities in the EV sector.

Table 15: Details of **Proposed Initiative 2**

Stakeholders	Role	Examples
OEM players	• Setting up service stations for women entrepreneurs • Tie-ups with financial bodies to seek loans for initial upfront costs of hard infrastructure as well as for day-to-day expenses • Offering on-the-job training to women entrepreneurs • Tie-ups with private training institutes to train women entrepreneurs	• Hero Electric • Okinawa Autotech • Kinetic Green • Mahindra Electric • Mitsui & Co, etc.
Women entrepreneurs	• Own & operate and run the service stations and conduct maintenance and repair activities for EVs • Undertake relevant training on servicing and repair and technology-related components including telematics • Hire/offer employment opportunities to women in these service stations	• Potential women entrepreneurs in DISHA states
Financial bodies/ funding agencies (public/private)	• Agencies to offer loans to women entrepreneurs at subsidized rates • Reduced collateral requirements for loans for these women entrepreneurs • Offer additional capital subsidy	• Finance companies such as Bajaj Allianz, Softbank Corporation • Bank loans with low interest rates: SBI Green Car Loan
Training partners	• Training institutions to offer training to women entrepreneurs on servicing and repair and technology-related components including telematics	• Academy of EV Technology • Advance Electrical Design & Engineering Institute • Automotive Skill Development Council, etc.
Multilateral agencies	• Act as facilitator between corporates and local agencies such as government bodies, women's self-help groups and local NGOs to mobilize potential women entrepreneurs in the DISHA states • Act as facilitator between women's enterprises and training partners	• UNDP

Figure 16: Business model for EV service stations operated by women



Financial feasibility of the Model

a. Investor Landscape:
   - Financial institutions to offer subsidized or low interest loans to women entrepreneurs basis tie-ups with corporates:
     - Subsidized interest rates
     - Interest free loans
     - Reduced collateral requirements;
   - Corporates can play the role of guarantors for securing vehicle loans for women entrepreneurs. They can also offer incentives or additional benefits to customers to approach these women-run service stations; and
   - Government to offer subsidies to women users
     - Central Goods and Services Tax refund
     - State Goods and Services Tax refund
     - Additional capital subsidy
     - Training grants
     - Interest free loans for up to three years.

b. Revenue Stream/Income Generation:
   - Women entrepreneurs to enter into exclusive tie-ups with OEM players in the electric space to meet market demand.

Future Scalability

- Corporates to enter into partnerships with battery manufacturing units such as Amara Raja, Exide, etc., to conduct battery recycling, reuse and remanufacturing activities within the service stations; and
- Women entrepreneurs to be provided with training on areas of battery manufacturing, management and disposal.

Proposed Initiative 3:

Women Operated Charging Station

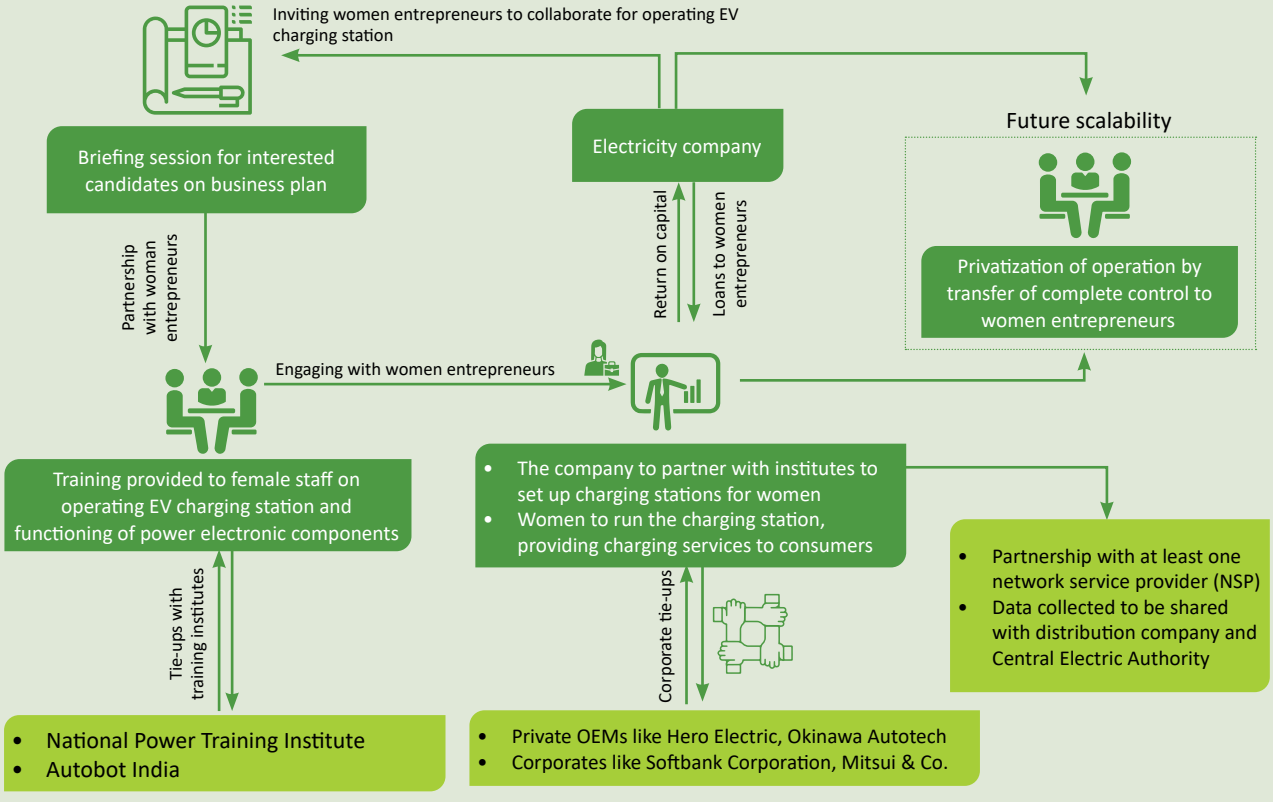
- One of the main barriers to EV adoption in the country is the lack of reliable, accessible and affordable charging infrastructure. In the absence of a robust charging infrastructure, growth in EV adoption will be difficult83. This creates demand for setting up of charging stations in order to fuel the EV industry in the nation.
- Women operated charging stations may be encouraged with the twin objectives of scaling up infrastructure for growing EV demand and enhancing women's participation in green transport;
- Partnering with at least one network service provider to facilitate advance remote/online

83 Soman, Abinav, et al., 2019. India's Electric Vehicle Transition Impact on Auto Industry and Building the EV Ecosystem.

booking of charging slots is made mandatory;

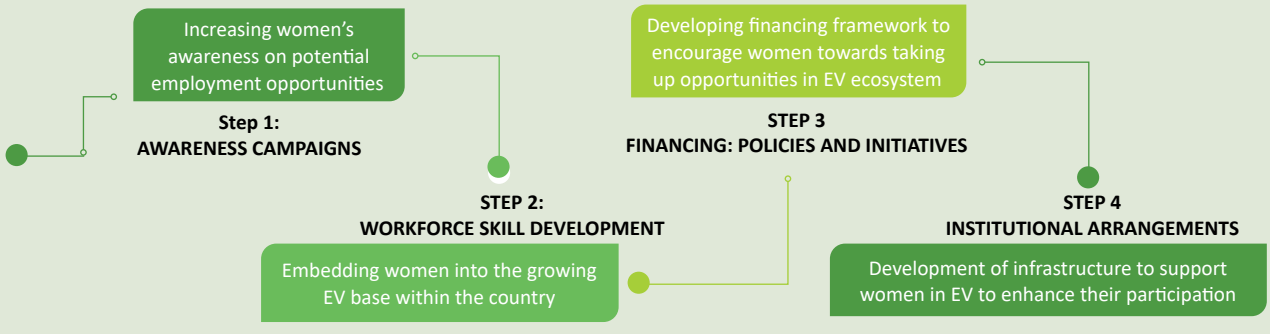
- Data collected from the owner have to be shared with the appropriate distribution company and also the Central Electric Authority so as to receive a clearance certifying that the station is ready to start servicing electric vehicles[84];
- Training may be provided on EV charging station design and manufacturing of power electronics and EVSE chargers;
- Mobilization of public and private players to set up hard infrastructure, which may then be operated by women (in the capacity of service providers) is required;
- Investment in EV charging infrastructure with operational control to women may be extended as benefits under corporate social responsibility policy; and
- Policies for charging service provider companies to conduct in-house training for women may be developed.

Figure 17: Business model for women operated EV charging station



The transition towards electric mobility with higher participation of women requires investment in certain areas of the EV ecosystem along with policy support and fiscal stimulus in terms of subsidies. To achieve this, four priority areas have been identified and the actions against each area has been mapped in Figure 18.

Figure 18: Roadmap for enhancing women participation in green transport



84 https://powermin.nic.in/sites/default/files/webform/notices/Charging_Infrastructure_for_Electric_Vehicles%20_Revised_Guidelines_Standards.pdf

Awareness Campaigns

Lack of awareness among women about potential employment options is a challenge for the industry. Actions required to address this issue involve:

- Increase public awareness about the job opportunities available for women by organizing national and state level workshops and job fairs by entering into partnerships with educational institutes and through use of social media platforms[100]; and
- Develop recruitment campaigns targeting women by:
  - Partnering with high schools and community colleges to promote careers in the industry and further expose young women to potential employment opportunities
  - Working with colleges to assess recruitment strategies for programmes where female students are significantly under-represented.

AWARENESS CAMPAIGNS

Government Organizations:

- Automotive Skill Development Council
- Ministry of Environment and Forests, Government of India

Industry associations:

- Society of Indian Automobile Manufacturers (SIAM)
- Society of Manufacturers of Electric Vehicles (SMEV)

Workforce Skill Development

EV manufacturing in the country will lead to the creation of new industries, thereby generating jobs within the sector. The EV charging infrastructure ecosystem is also anticipated to be an area of growth, leading to generation of ample employment opportunities.

Actions for embedding women into the growing EV base within the country include:

- Tie-ups with training institutes and introduction of courses that offer specialized and customized training and development programmes for women on various areas of the EV ecosystem;
- Create training modules to upgrade capacity of the existing female workforce; and
- Encourage re-training for unskilled and semi-skilled women workers in the automotive industry.

WORKFORCE SKILL DEVELOPMENT

Training institutes:

- Advance Electrical Design and Engineering Institute
- Automotive Skill Development Council
- National Power Training Institute, etc.

Private OEMs:

- Hero Electric
- Mahindra

100 WRI India, Electric Mobility Roadmap for Smart Cities in.

Financing: Policies and Initiatives

A well- designed financing framework is required to encourage women to take up opportunities in the EV ecosystem[101]. This includes:

- Developing policies for charging service provider companies to conduct in-house training for women;
- Relaxing tender allotments for enterprises owned and run by women and employing a specific proportion of women;
- Defining standards for adopting recycled/secondary products and having corporates mandates to train women in them;
- Providing tax benefits to corporates co-investing in women-run enterprises;
- Providing fiscal support to carry out market awareness campaigns, skill development and capacity building for women users;
- Shaping policies and regulatory measures against offensive behaviour in the working environment and offering women employees benefits such as maternity leave, comfortable working hours and shift timings; and
- Deploying the special provisions in FAME II (under NEMMP) for women in the EV manufacturing space.

FINANCING: POLICIES AND INCENTIVES

Government Organizations:

- NITI Aayog
- Ministry of Heavy Industries & Public Enterprises
- Ministry of Road Transport & Highways

Industry Associates:

- Confederation of India Industry
- Society of Manufacturers of Electric Vehicles
- Society of Indian Automobile Manufacturer

Institutional Arrangements

Development of infrastructure to support women in the EV industry by the government and corporates is required to enhance their participation within the sector. This includes:

- Creation of new skill centres specifically for women through collaborations between industry, academia and the government;
- Allocation of space by the government for women-run service stations with lower transfer duty and other exemptions; and
- Mobilization of public and private players to set up hard infrastructure, which may then be operated by women (in the capacity of service providers).

INSTITUTIONAL ARRANGEMENTS

Government Organization:

- Ministry of Housing & Urban Affairs
- Automotive Skill Development Council
- Ministry of Road Transport & Highways

101 Chandra, Sayandeep and Mazumdar, Shubhankar, 2020. Roadmap for Electric Vehicle Implementation in India.

5.

Annexures

PEER REVIEWERS TO THE SECTORAL STUDIES

Sectoral Chapters	Peer Reviewer
Renewable Energy	Dr. Srinivas Shroff Nagesha Rao, *Chief Executive Officer, REC Foundation*
Green Construction	Suneel Padale, *Director Programs, CARE India*
Green Transport	Hitesh Vaidya, *Director, NIUA*
Water Management	Moho Chaturvedi, *Consultant Water Resources and Environment*
Carbon Sinks- Forests	Vishaish Uppal, *WWF India*
Carbon Sinks- Marine Fisheries	Ramya Rajagopalan, *Independent Researcher*

STAKEHOLDER INTERACTION

Sr. No.	Name	Expert/ organization	Designation
1	Mr. Arindam Lahiri	Automotive Skills Development Council	CEO
2	Mr. Amit Bhatt	WRI India	Director, Integrated Transport
3	Mr. Vivek Chandran	Shakti Sustainable Energy Foundation	Associate Director, Transport
4	Mr. Dinesh Goyal	Konark Energy	CEO
5	Mr. Tarun Songra	AECOM	Individual Expert
6	Mr. Vivek Shrivastav	Shigan Evoltz	Individual Expert
7	Ms. Shilpi	Ola	Individual Expert
8	Mr. Alok Ray	Society of Manufacturers of Electric Vehicles	Individual Expert

FORMULAE USED FOR CALCULATIONS

1. **Domestic Value Added**

   Domestic value add in 2030(INR)= (CostA * Salesa) + (CostB * Salesb) = Domestic value addA + Domestic value addB

   Where,

   CostA: cost of indigenized powertrain components in an ICE car in 2030 in INR

   (Note: We consider the cost of ICE car components to be the same for 2018 and 2030)

   Salesa: new sales of ICE cars in 2030, based on the scenarios discussed in Figure 6.

   CostB: cost of indigenized powertrain components in an electric car in 2030 in INR

   (Note: We consider the cost of powertrain-related components in an electric car to remain the same in 2018 and 2030, but we assume the cost of the battery to fall. Additionally, the battery, in 2018, comprises 40 percent of the cost of an electric vehicle, and we estimate this share to decrease to 18 percent by 2030.)

   Salesb: new sales of electric cars in 2030, based on the penetration of electric cars in the scenarios discussed in Figure 6.

2. **Employment**

   Jobs supported= (Domestic value addA * Job CoefficientC) + (Domestic value addB * Job CoefficientD)

Where,
Job CoefficientC: number of jobs supported by manufacturing ICE car powertrains per INR 10 million of value added, which is 1.59 jobs/INR millions of outputs.

Job CoefficientD: number of jobs supported by manufacturing electric car powertrains per INR 10 million of value added, which is 0.35 jobs/INR millions of outputs.

KEY CHARGING STATION OPERATORS IN INDIA

S. No	EV Component	Number of Charging Stations	Key Notes
1	Ola	Nagpur (4)	• First charging station in India was set up by Ola in Nagpur with investment of INR 500 million • Increase in drivers' working hours as car charging required 4- 5 hours • Partnered with Mahindra Electric to pilot EVs in Nagpur • Indian Oil Corporation to set up charging stations • Plans to add 10,000 EVs in one year, majority being e-rickshaws
2	Tata Power	Mumbai (12)	• Partnership with Tata Motors to support their EV deployment
3	Ather	Bengaluru (30)	• Entered into an agreement with Sanmina Corporation that will exclusively manufacture Ather's charging system, battery management systems and dashboards at its state-of-the-art manufacturing facility in Chennai, India • Free charging for vehicle owners for the first 12 months • Free charging shall be followed by a monthly subscription fee for charging, support and maintenance
4	Lithium Urban Cabs	Bengaluru (70), Delhi (20)	• Business to business strategy • Plans to set up 60 public chargers across Delhi-NCR • State government to provide financial assistance • Plans to expand operations in Pune, Mumbai, Chennai and Hyderabad
5	SmartE cabs		• Partnership with Delhi Metro to rollout e-rickshaws • Signed partnership with more than 15 organizations • Served more than 20 million passengers in the first two years of operation • Make revenues from internal/external brandings in e-rickshaws
6	Hyderabad Metro Rail Limited	24 (under implementation)	• Partnership with L&T and Power Grid Corporation of India on a pilot basis to understand market response
7	Bangalore Electricity Supply Company Ltd.	11 (under implementation-10)	• Charges end-users on time of day basis once approved by the state commission

S. No	EV Component	Number of Charging Stations	Key Notes
8	Fortum (Finnish Clean Energy Company)	None	• Signed a Memorandum of Understanding with NBCC (India) for developing changing infrastructure across India in an upcoming project • Plans to set up 150 charging stations in the next 12-18 months
9	Bombay Suburban Electric Supply	2	• A Memorandum of Understanding with Indian Railways (pilot project) • Indian Railways will pay 8 cents/kilowatt per hour as charging tariff once approved by the regulator
10	Mahindra Reva Electric	Bengaluru (25), Delhi (6)	• Installed under FAME scheme

KEY AUTOMOTIVE PLAYERS IN INDIA

S. No	Automobile Players	Vehicle Category	EV Running Models
1	Mahindra Electric	Four-wheelers	eSupro (2), e20 Plus, eVerito
2	Tata Motors	Four-wheelers	Tigor
3	Honda	Four-wheelers	None
4	Nissan	Four-wheelers	Nissan Leaf
5	Ashok Leyland	Buses	Circuit S
6	Tata Motors	Buses	Starbus (Hybrid) Ultra-Electric
7	Eicher Motors	Buses	Smart Electric Skyline Pro E
8	Goldstone - BYD	Buses	eBuzz K6, Goldstone BYD K9, Goldstone BYD K7
9	Ather Energy	Two-wheelers	Ather 340, Ather 450
10	Bajaj	Two-wheelers	None
11	TVS	Two-wheelers	None
12	Okinawa Autotech	Two-wheelers	Praise Ridge
13	Hero Electric	Two-wheelers	High Speed Series (3), Super Economy Series (5), Electric NYX E5
14	Hero Electric	Two-wheelers	Raahi (e-rickshaw), Rex 400 E-Tipper E-Loader
15	Mahindra Electric	Three-wheelers	eAlpha
16	Lohia	Two-wheelers	OMA Star, OMA Star Li
17	Lohia	Three-wheelers	Humrahi Series (2), Narain Series (1), Comfort Series (3)
18	Kinetic Green	Three-wheelers	Safar (1), Buggies (5)

JOB ROLES ACROSS THE VALUE CHAIN

MANUFACTURING-I											
Automobile Manufacturing											
NSQF Level	**Vehicle Assembly**				**QP**	**Casting**	**QP**	**Forging**			**QP**
Level 6	Assembly Line Manager				✗	Casting Line In-charge	✓	Forging Shift In-charge			✓
Level 5	Assembly Line Supervisor	✓	Battery Line Supervisor, Battery Handling and Disposal Arrangement Supervisor		✗	Casting Supervisor	✓	Forging Line Supervisor			✓
Level 4	Vehicle Assembly Fitter, Technician and Auto Component Assembly Fitter	✓	Diagnostics and Troubleshooting Operator		✗	Pressure Dye Casting Operator and Casting Technician– Sand Moulding	✓	Forging Operator			✓
Level 3	Battery Fitting, Associated Wiring and Charging Technician				✗	Casting Technician	✓				
Level 2	Equipment Assembler				✗	Foundry Assistant/Casting Assistant and Melting Assistant/Helper	✓				

MANUFACTURING-II											
Automobile Manufacturing											
NSQF Level	**Machining**	**QP**	**Maintenance**			**QP**	**Pressing**	**QP**	**Tool Room Operation**		**QP**
Level 6	Machining Setter, Master Technician	✓	Manager Maintenance, Mechanical and Electrical	✓	Manager Mechatronics	✗	Press Shop Line- In Charge	✓			
Level 5	Machine Shop Supervisor	✓	Automation Specialist			✗	Press Shop Supervisor	✓	Tool Designer and Tool Room Supervisor		✓
Level 4	CNC Operator/ Machining Technician L4	✓	Maintenance Technician- Mechanical, Electrical	✓	Maintenance- Mechatronics	✗	Press Shop Operator	✓	Tool Room Operator/ Technician		✓
Level 3	CNC Operator/ Machining Technician L3	✓	Maintenance Technician- Mechanical, Electrical	✓	Maintenance- Mechatronics	✗					
Level 2	Machining Assistant	✓	Maintenance Assistant			✓	Press Shop Helper	✓			

MANUFACTURING-III											
Automobile Manufacturing											
NSQF Level	**Welding**	**QP**	**Supply Chain Management**	**QP**	**Painting**	**QP**	**Industrial Engineering**				**QP**
Level 6	Welding Machine Setter/Master Welder	✓	Material Coordination Manager and Manager Vendor Development	✓	Painting & Surface Treatment Shift- In Charge	✓	Industrial Engineer (Workstation Design) and Process Design Engineer				✓
Level 5	Welding Supervisor	✓	Manager Stores Operation and Vendor Development Executive	✓	Painting Supervisor	✓	Method Study Executive + Industrial Engineer (Layout Design) + Equipment Designer + Process Validation Executive-	✓	Mechatronics Engineer		✗
Level 4	Welding Technician	✓			Automotive Painting Technician	✓	Process Tryout Engineer (Mechanical)	✗	Process Tryout Engineer (Electrical and Mechatronics)		✗
Level 3	Welding Technician	✓	Parts Picker	✓	Automotive Painting Technician	✓	Process Tryout Engineer (Mechanical)	✗	Process Tryout Engineer (Electrical and Mechatronics), End of line Testing Technician		✗
Level 2	Welding Assistant	✓	Loading/Unloading Operator, Packing Assistant/Packer	✓	Automotive Paint shop Assistant	✓					

MANUFACTURING-IV													
Automobile Manufacturing													
NSQF Level	**Plastic Moulding**	**QP**	**Surface Treatment**	**QP**	**Heat Treatment**	**QP**	**Soldering and Brazing**	**QP**	**Super Finishing**	**QP**	**Quality Assurance**	**QP**
Level 7											Manager/ Supervisor Manufacturing Quality	✓
Level 6	Plastic Moulding Shifting -Charge	✓			Heat Treatment Shop Metallurgist	✓					Manager Supplier Quality and Manager/ Supervisor Customer Quality	✓
Level 5	Plastic Moulding Supervisor	✓			Heat Treatment Shop Supervisor	✓					QA Standards in Charge	✓
Level 4	Plastic Moulding Operator/ Technician	✓	Surface Treatment Technician	✓	Heat Treatment Technician	✓	Soldering and Brazing Technician	✓	Super Finishing Technician	✓	QC Inspector	✓
Level 3											QC Inspector	✓
Level 2	Plastic Moulding Helper	✓										

MANUFACTURING-V										
	Automobile		**Battery Manufacturing**				**Charging Equipment Manufacturing**			
NSQF Level	**Manufacturing (Non-formal)**	**QP**	**Procurement**	**QP**	**Assembly**	**QP**	**Manufacturing**	**QP**	**Technical Specs. & Testing**	**QP**
Level 7					Testing Engineers	×	Sr. Electrical and Electronics Engineer	×	Manager - Development and Testing of Charger	×
Level 6			Procurement Engineers	×	Maintenance and Safety, (Five S)	×	Production Managers and EEE Engineers	×	Sr. Testing and Design Engineers + Quality and Design Engineers	×
Level 5			Quality Check Supervisor	×	Supervisors	×	Technical Assistants	×	Testing and Design Engineers	×
Level 4	Lathe Operator and Repair – Welder	✓			Installation, Commissioning Maintenance and Safety	×	Technicians	×	Documentation Supervisor	×
Level 3									Draughtsman and Technician	×

CHARGING INFRASTRUCTURE ECOSYSTEM												
	Operations						**QP**	**Service & Maintenance**	**QP**	**Infrastructure**	**QP**	
NSQF Level	**Customer Care**		**Fast Charging**		**Security**	**Tire Inflation**						
Level 10	Charging Station Owner/CEO/MD/President						×					
Level 9	GM/VP Charging Station Operations						×					
Level 8								Sr. Manager				
Level 7								Sr. Testing and Servicing Engineers		Urban and Regional Sr. Planners	×	
Level 6	Charging Station Manager						×	Testing Engineers		Urban and Regional Planners	×	
Level 5			Charging Station Operator	×								
Level 4			Battery Swapping Attendant	×				Technical Assistants				
Level 3								Technicians				
Level 2	QCP Attendant	✓			Guard	×	Tyre Inflation Attendant	✓				

DIGITAL TECHNOLOGY		
NSQF Level	**Software Solutions**	**QP**
Level 9	Business Unit Head	×
Level 7	Product Marketing	×
Level 6	Technology Specialist and Middleware expert	×
Level 5	Web Designer, Hardware Specialist	×

CUSTOMERS/SALES										
Sales OEM										
NSQF Level	**Commercial**	**QP**	**Automotive Retail**	**QP**	**Key Accounts**	**QP**	**Sales Support**	**QP**	**Used/Pre-Owned Vehicles**	**QP**
Level 7			Automotive Sales Lead (Retail)	✓	Regional Sales Manager	✓				
Level 6	Commercial Manager (Zonal/ Regional)	✓					Regional Sales Development/ CRM Manager	✓	Regional Sales Manager (Used/ Pre-owned Vehicles)	✓
Level 5	Commercial Executive / Officer	✓	Sales consultant (Retail)/Territory Sales Manager (Retail)	✓	Key Accounts Sales Manager	✓			Territory Sales Manager (Used/ Pre-owned Vehicles)	✓

CUSTOMERS/SALES										
Sales OEM II										
NSQF Level	**Marketing & Branding**	**QP**	**Digital/Social Media**	**QP**	**Dealer Development**	**QP**	**Training**	**QP**	**Finance & Insurance**	**QP**
Level 7	Marketing Manager-Line of Business	✓								
Level 6	Product/Brand Manager	✓	Social Media & Digital Marketing Manager	✓	Regional Dealer Development/ Network Expansion Manager	✓	Sales Training Manager	✓	Regional Retail Finance & Insurance Manager	✓

CUSTOMERS/SALES										
Sales Vehicle Ownership I (Showroom)										
NSQF Level	**Finance & Insurance**	**QP**	**Customer handling**	**QP**	**Marketing**	**QP**	**Value Added Services**	**QP**	**Pre-Delivery**	**QP**
Level 7			Customer Relationship Manager	✓	Marketing and Social Media manager	✓				
Level 6									PDI In-charge	✓
Level 5	Sales Officer (Auto Insurance)/ Finance, Insurance, Registration Coordinator	×							PDI Supervisor	✓
Level 4	Sales Consultant (Automotive finance)	×	Tele-caller/ Customer Relationship Executive/ Dealership Driver	✓			Sales Executive (Accessories Value added services)	✓	Accessory Fitter	✓
Level 3			Showroom host	✓					Washer	✓

CUSTOMERS/SALES								
Sales Vehicle Ownership II								
NSQF Level	**Institutional/Fleet/ Corporate Sales**	**QP**	**Field Sales**	**QP**	**Used/ Pre-owned vehicles**	**QP**	**Training**	**QP**
Level 8	Sales Manager							✓
Level 7					Sales Lead (Pre-owned Vehicles)			
Level 6	Sales consultant (Institutional Sales)	✓	Home Installer/ Home delivery Manager	✓	Sales Consultant (Pre-owned Vehicles)	✓	Sales/Service Trainer (Dealer)	✓
Level 4	Sales Consultant							✓
Level 3	Sales Executive- Dealership							✓

AFTER SALES SERVICE							
Service OEM							
NSQF Level	**Tech. Support**	**Key Accounts**	**Spare Parts**	**Service Marketing**	**Service Process**	**Training**	**Service Office**
Level 6	Area Technical Lead and Area Service Manager ✓	Key Accounts Service Manager ✓	Regional Parts Manager and Regional Manager- Customer Care✓	Regional Service Marketing Manager ✓	Regional Service Process Manager ✓	Service Training in Charge Centre ✓	
Level 5	Territory Service Manager ✓		Area Parts Manager ✓			Trainer-Service ✓	Service Office Manager- ✓
Level 4							Service Office Executive- ✓

AFTER SALES SERVICE												
Service Vehicle (Authorized Centres)-I: Workshop												
NSQF Level	**Mechanical/ Electrical/ Mechatronics Service & Repair**			**QP**	**Other Aggregate Specialists**	**QP**	**Quality Control**	**QP**	**Workshop Operation**	**QP**	**Reconditioning Workshop**	**QP**
Level 8									Workshop Manager	✓		
Level 7									Body Shop In-Charge	✓		
Level 6							Quality Controller	✓	Service Advisor	✓		
Level 5	Automotive Servicing Supervisor			×								
Level 4	Automotive Service Technician, Automotive Engine Repair Technician and Automotive Electrician	✓	Wheel Alignment Technician	×	Break Battery and Wiring Specialist	×			Maintenance Technician - Service Workshop	✓	Repair Welder	✓
Level 3	Automotive Service Technician			✓								
Level 2	Washer			✓								

AFTER SALES SERVICE						
Service Vehicle (Authorized Centres)-II						
NSQF Level	**Spares**	**Customer Handling**	**Warranty Process**	**Training**	**Denting**	**Painting**
Level 7	Spare Parts Operations in Charge ✓					
Level 6			Warranty in Charge ✓			
Level 5	Spare Parts Operations Executive ✓					
Level 4		Customer Relationship Executive ✓	Warranty Processor ✓	Sales/Service Trainer ✓	Auto Body Technician ✓	Repair Painter Auto ✓
Level 3	Spare Parts Operations Executive ✓				Auto Body Technician ✓	Repair Painter - Auto body- ✓

AFTER SALES SERVICE				
Service Vehicle (Unauthorized Centres)				
NSQF Level	**Organized**	**QP**	**Roadside**	**QP**
Level 4	Wheel Alignment Technician	×	Wheel Alignment Technician	×

✓: Job roles with QPs present

×: Job roles with no QP

Value Chain Component	Job Role	Description
Job roles that require up-skilling		
Manufacturing	Draughtsman/ Draughtsperson	The EV industry will replace the R&D and manufacturing in automotive sector by battery and charger segments. Thus, different skills and qualifications will be required from the Draughtsman for the replaced job. A mechatronics background is essential with knowledge of mechanical, electrical, electronics and IT.
New Jobs Roles		
Manufacturing	Equipment Assembler	Building and assembling electromechanical components such as electric motors, computers, electronic control devices
	Tool Designer and Tool Room Supervisor	New job roles will be added to the existing tools' team for accommodation of new electromechanical components like electric motors and generators, control and sensing devices which are added to for all battery related operations
	Tool Room Operator/ Technician	
	Heat Treatment Shop Supervisor	Supervise a team handling thermal management at an electromechanical front on the shop floor Responsible for ensuring cooling of power technology and static devices at the shop floor level
	Heat Treatment Shop Technician	Team responsible for handling thermal management at an electromechanical front. Cooling of power technology and static devices
	Process Tryout Technician	For facility and equipment benchmarking for battery handling, assembly, validation and testing
	Quality Check Supervisor	Check if the procured cells fit the quality norms and standards

Value Chain Component	Job Role	Description
	Supervisors	To ensure that the safety and quality standards are being maintained at every phase of the battery assembly process
	Draughtsman	Preparation of basic sketches to full working drawings
	Technicians	For supporting the engineers with their hands-on expertise. Preferably with an EEE background
	Prototype Manufacturing	Backgrounds in electrical for electrical components, electronics for control systems, software developers and Mechatronics having broad knowledge of all the aforementioned sectors
	Installation and Commissioning Technician	Cells need to be assembled to form the actual battery along with the associated circuitry once they pass the quality norms from the procurement team. A background in Electrical and Electronics with training in fitting all the components together is needed
	Diagnostics and Troubleshooting Operator	Responsible for testing at the end of the battery assembly line, battery diagnostics, software flashing and parameterization in battery management system
	Battery Fitting, Associated Wiring and Charging Technician	For assembling the battery and the associated wiring in the car
	Battery Line Supervisor, Battery Handling and Disposal Arrangement Supervisor	To manage and supervise the newly added assembly line. Responsible for battery diagnostics, software flashing and parameterization in battery management system
	Documentation Supervisor	Supervises, prioritizes and coordinates the daily activities of a documentation staff within the department
	Battery Fitting, Associated Wiring and Charging Technician	For assembling the battery and the associated wiring in the car
	Battery Line Supervisor, Battery Handling and Disposal Arrangement Supervisor	To manage and supervise the newly added assembly line, an expert in battery handling and disposal management. Education background would be of Chemical and/or EEE
	Procurement Engineers	Electrical, Chemical, Metallurgy Engineers to understand quality norms, negotiate, and check compatibility with existing system to procure good quality cells
	Testing Engineers	Testing needs to be done at every level of battery assembly to ensure highest quality
Charging Infrastructure Ecosystem	Battery Swapping Attendant	Person trained in battery handling and swapping discharged batteries from the incoming customers with charged ones
	Charging Station Operator	Trained personnel capable of handling high voltage systems required for fast charging
	Sr. Electrical and Electronics Engineer	Assessment, selection, installation, and inspection of an EV charger
	Technical Assistants	For supporting the engineers with their hands-on expertise. Preferably with an EEE background
	Technicians	
	Production Managers and EEE	Participating in all phases of product development including product definition, architecture, layout, analogue circuit design and lab evaluations and debugging

Value Chain Component	Job Role	Description
Digital Technology	Business Unit Head	Responsible for planning the administrative services of a company. Incorporate policies and procedures of the company in business unit operations. Monitor and review company's project activities and ensure that they are brought to completion within scheduled period of time and budget
	Product Marketing	Develop new product messaging Maintain and deepen competitive intelligence across product landscape with sales support, product management support, marketing support and primary research and perform market research in support of competitive intelligence and product messaging efforts
	Technology Specialist	To provide data acquisition, interpretation, data base management, and ensure safety of the data
	Middleware Expert	Support cross-functional project teams to fill in middleware design gaps
	Web Designer, Hardware Specialist	Installs desktop hardware, operating systems, applications, and other software through approval via change control process and troubleshoot repairs/replaces hardware, operating system, application, and software as required
After Sales Service	Break, Battery and Wiring Specialist	Replacement of the entire brake/clutch section of the car by battery and wiring will lead to some replacement of the car repair/servicing industry with respect to the technicians
	Technical Assistants	For troubleshooting, visual inspection of equipment for unusual conditions, overheating, etc., cleaning of the switchboard surface to remove debris and dust, checking lighting, sockets, emergency lighting of cinema, checking and re-tightening any loose bolts and nuts in proper sequence for electrical, mechanical devices
	Technicians	Repairs and maintains the chargers and performs routine maintenance and breakdown repair work in the field at customer sites
	Sr. Manager	To give technical service and support and ensuring right process and quality standards are followed at fabricators by trainings and audit
	Sr. Testing and Servicing Engineers	Validate requirements through design test, analysis, inspection, or demonstration
	Testing Engineers	Ensuring the circuits and hardware needed for battery charge management, power distribution, and voltage/current/power sensing
Job roles that require reskilling		
Manufacturing	Assembly Line Supervisor	Reskilling required on battery handling and on handling AC and DC circuitry
	Maintenance Assistant	Reskilling to have additional knowledge of electric systems drive train and electric components
	Vehicle Test Driver	Some amount of reskilling with respect to mechatronics knowledge is required as the final product would be an electrically driven vehicle
	Assembly Line Manager	The vehicle assembly line would be modified in such a way that it would incorporate the addition assembling of the battery inside in the vehicle. Necessary training should be provided to facilitate this task. The Assembly Line Manager will be essentially be responsible for vehicle body assembly, body assembly, battery management system and battery disposal
	Prototyping Engineer	Coordinate with all engineering (Mechanical, EEE, IT) departments to plan and execute research and development related to EV technology
	Manager Test Facility (R&D infrastructure)	Since the final product would be an electrically driven vehicle the same job rule would persist but with reskilling with respect to more mechatronics knowledge
	Test Engineer Product/ Vehicle	
	Supervisor R&D testing (indoor, product)	

Value Chain Component	Job Role	Description
Customers/Sales	Sales Training Manager	With respect to the changes in the car, new specifications of the car and the functioning of an EV, reskilling is required for the sales team
	Accessory Fitter	
	Sales Executive (Accessories Value added services)	
	Sales Consultant (Automotive Finance)	
	Showroom host	
	Sales Consultant (Pre-owned Vehicles)	
	Sales Consultant Level 4	
	Regional Sales Manager (Used/Pre-owned Vehicles)	
	Territory Sales Manager (Used/Pre-owned Vehicles)	
	Product/Brand Manager	
	Social Media & Digital Marketing Manager	
	Regional Dealer Development/ Network Expansion Manager	
	Sales/Service Trainer (Dealer)	
After-sales Service	Trainer Service	Some amount of reskilling with respect to mechatronics knowledge is required as the final product would be an electrically driven vehicle
	Automotive Service Technician (2 & 3 wheelers)	Regular repair workers are able to carry out majority of the routine servicing, but the electrical systems and drivetrain will often need reskilling of workers to make them more familiar with electrical vehicles
	Automotive Engine Repair Technician Level 4	
	Automotive Electrician Level 4	
	Automotive Service Technician Level 4	
	Maintenance Technician-Service Workshop	
	Spare Parts Operations Executive Level 5	
	Spare Parts Operations Executive Level 3	
	Sales/Service Trainer	
	Regional Manager- Customer Care	Since the final product would be an electrically driven vehicle the same job rule would persist but with reskilling with respect to more mechatronics knowledge
	Regional Parts Manager	
	Area Parts Manager	
	Service Training in Charge Centre	

Disclaimer:

Due to COVID 19 pandemic and the travel restrictions, the report is purely based on secondary sources and information obtained by KPMG from organisations, experts and through stakeholder interactions. This report sets forth information based on the completeness and accuracy of the facts stated and any assumptions. The comments in the report are not intended, nor should they be interpreted to be legal advice or opinion.

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