INVESTMENT LANDSCAPE OF INDIAN E-MOBILITY MARKET

SOUTH ASIA REGIONAL ENERGY PARTNERSHIP (SAREP) AND INVEST INDIA

March 2023
ACRONYMS AND ABBREVIATIONS

ACC: Advanced Chemistry Cell
BMS: Battery Management System
DFI: Development Finance Institution
DISCOMs: Distribution Companies
E2W: Electric 2-Wheeler
E3W: Electric 3-Wheeler
E4W: Electric 4-Wheeler
EV: Electric Vehicle
FAME: Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India
FDI: Foreign Direct Investment
GCC: Gross Cost Contract
GHG: Greenhouse Gas
GW: Gigawatt
GWh: Gigawatt Hour
ICE: Internal Combustion Engine
kWh: Kilowatt Hour
LCO: Lithium Cobalt Oxide
LFP: Lithium Iron Phosphate
LMO: Lithium Manganese Oxide
MaaS: Mobility as a Service
MHI: Ministry of Heavy Industries
NCA: Lithium Nickel Cobalt Aluminum Oxide
NEMMP: National Electric Mobility Mission Plan
NMC: Lithium Nickel Manganese Cobalt
OEM: Original Equipment Manufacturer
PE: Private Equity
PLI: Production Linked Incentives
R&D: Research and Development
STU: State Transport Undertaking
TCO: Total Cost of Ownership
VC: Venture Capital
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ACKNOWLEDGEMENTS

This report has been prepared under the USAID’s South Asia Regional Energy Partnership (SAREP). Authors of the report are as follows:

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We would like to express our sincere gratitude to USAID India for ideation and guidance during the study, with special thanks to Ms. Apurva Chaturvedi. We would also like to thank Ms. Ravneet Mann (Invest India) and Mr. Rakesh Goyal (RTI International) for their views and inputs that has enriched the report as well as for the support and collaboration throughout the study.

The publication of this report would not have been possible without contributions from many stakeholders, including e-mobility ecosystem players, institutional investors and other subject matter experts, who generously provided their time and inputs during the consultation process.

Finally, we would like to thank the readers of the report for taking the time to review the findings and conclusions. We hope that this report will provide valuable information and insights to the investors and financing institutions that will be useful in shaping the investment landscape for the electric mobility sector in India.

Suggested Citation:
Invest India and SAREP 2023. Investment landscape of Indian e-mobility market
The Indian automobile industry has always been a great investment story, being the third largest in the world. The electric mobility sector too has gained significant traction and is expected to grow at an annual growth rate of 49% till 2030. In 2022, India reached a major milestone of selling 1 million EVs. EVs recorded robust growth in 2022, supported by the implementation of favourable policies and program by the government.

There are innovative business models and technologies coming up in the space every day and the Indian start-up ecosystem is poised to spearhead the revolution that is required for the mobility market. In 2022, EV start-ups in India raised over US$1.6 billion in 2022, a 117 per cent increase from 2021, which speaks about the investment potential of the sector. The potential for investment is estimated to be over US$200 billion, and along with the enabling policy environment, the growth trajectory of the sector is going to be steep.

USAID is committed to assisting India in achieving its ambitious targets in the clean energy transition space particularly in the e-mobility ecosystem. Through its past programmes, USAID has assisted in designing and deployment of public charging infrastructure for EVs, supported formulation of EV related policies, development of business models, development of partnerships and scaling up EVs with the help of Discoms.

This report, developed by USAID’s South Asia Regional Energy Partnership (SAREP) in collaboration with Invest India, is intended to provide necessary context on the Indian e-mobility landscape to investors, as well as highlight the potential this sector holds, to encourage the deployment of capital into this sector.

I hope readers will find this report to be a useful resource in navigating and deploying capital in the Indian e-mobility sector.
FOREWORD

Having turned 75 last year, India now stands at a turning point in its history. It is firmly on the path to join the developed nations club in the next few years. India has achieved one of the world’s highest growth rates and quintupled its per-capita income since 2000. It is expected to emerge as the third-largest economy by the end of this decade. With India assuming G20 Presidency, the country finds itself at the centre of the global economic transformation, driven by multiple developments including the after-effects of the global pandemic, existing geopolitical challenges, acceleration of technology adoption, and shifting global value chains. India is already acknowledged as amongst the brightest spots in the post-pandemic economy and is expected to be the world’s fastest-growing major economy in 2023, with overall consumption, spending, and investments all showing significant growth.

The Indian growth story is resilient and robust. India is amongst the world’s most preferred investment destination, a trusted global partner gearing to touch the USD 10 trillion mark by 2035. With stable macroeconomic fundamentals, and a visionary leadership, India is focused on creating a sustainable, digitally driven, innovation-centric economy. The next 25 years, India’s ‘Amritkaal,’ will witness the rise of a futuristic, prosperous, inclusive, and developed society, distinguished by a human-centric approach at its core.

As the third largest automotive market in the world, India has the opportunity to lead the global transition from traditional ICE vehicles to a more efficient and decarbonised Electric Vehicle (EV) technology. Indian auto sector has cumulatively received ~ USD 25 Bn in FDI over the last two decades. In terms of the EV industry, the sector received a record-breaking USD 3.6 billion in funding in FY23. This is from over 250 businesses including startups, across all market segments. The sector has also seen significant investment from a wide range of investors, including PE and VC funds, sector-focused funds, and international strategic assets.

Favourable government initiatives like FAME II, the two Production Linked incentive Schemes (Auto & ACC), the recently announced budget exemptions for customs duty on capital goods machinery for manufacture, and the duty cut on lithium-ion batteries from 21% to 13% have all contributed to the sector’s expansion and are expected to lower prices and further boost investment in the industry.

Invest India, the world’s most awarded investment promotion agency is working to facilitate major investments and position India as the world’s fastest-growing economy. Our facilitation efforts reflect the country’s growth priorities where we work across all sectors and have witnessed a remarkable rise in the global interest. Considering India’s leading position in the global auto market, this once in a decade transition presents a tremendous opportunity for investors to be a part of the India growth story.

Scan to know more about Invest India Sector team:
The global electric mobility sector has seen significant growth in the last few years. The success of the sector has largely been attributed to policy support globally, as well as increasing concern around climate change. The growth of the sector has so far been driven by China, followed by the United States of America, and Europe, given that electric vehicle (EV) manufacturing and the upstream value chain is currently concentrated in China. With an increasingly unstable geopolitical climate, companies are looking to diversify their EV supply chains, and India is increasingly being perceived as a frontrunner in this regard. This is primarily due to the policies and incentive schemes launched by the Government of India and the availability of low-cost labor.

EV adoption in India has increased at an annualized rate of 55% since 2018, and the market is expected to grow at a rate of 49% till 2030. Adoption has been especially high in the electric 2-wheeler (E2W) and electric 3-wheeler (E3W) segments. However, some of the challenges that remain in the sector include:

**Investment constraints:** Information asymmetry exists amongst investors given the nascent stage of the sector & rapidly evolving technology. Moreover, financiers are unable to assess company assets due to uncertainty around useful life, salvage value and the lack of a secondary market.

**Limited availability of end-user financing options:** Most traditional financiers are still hesitant to finance EVs and have limited products tailored to the e-mobility sector. Moreover, rates for leasing EVs are extremely high, usually upwards of 20%.

**Inadequate supporting infrastructure:** Consumers are hesitant to adopt EVs because of range anxiety and limited public charging infrastructure available in the country.
Despite these challenges, India has seen significant investment into its e-mobility sector from investors ranging from original equipment manufacturers (OEMs), development financing institutions (DFIs) to non-banking financing companies (NBFCs), private equity funds (PEs) and venture capital funds (VCs). The government has also made the sector completely open to foreign direct investment (FDI) to further boost investment. Several DFI-led programs with a mandate to stimulate the private sector in emerging markets, are increasing their participation and support to the sector through low-cost capital and risk mitigating mechanisms.

A majority of the investment has been directed toward EV OEMs, charging infrastructure, and Mobility as a Service (MaaS). Investment into the battery manufacturing sub-sector has been picking up, encouraged by government incentives such as the PLI (production linked incentive) scheme for advanced cell chemistry batteries. Investment into the battery sector can have a catalytic impact on EV adoption by driving prices of EVs down. The EV auto components sector, however, is still currently highly dependent on imports due to the advanced technology.

Indian companies are continuously innovating to adapt to the dynamic e-mobility market. In addition to companies that have scale and strategic partnerships, companies that are focused on meeting challenges specific to the Indian sub-continent and indigenizing their product to avoid supply chain bottlenecks are increasingly attractive to investors. Moreover, companies that are integrating various segments of the e-mobility value chain have been able to stand out in the sector.

With a cumulative investment opportunity of over $200 billion in the next 8-10 years, India is poised to become the largest EV market by 2030. Many OEMs have established separate EV subsidiaries and are raising finance at the subsidiary’s corporate level. As the electric 2-wheelers (E2W) and electric 3-wheelers (E3W) segment is dominated by start-ups, this segment is looking at receiving direct investments. As demand for EVs increase, there will be significant increase in the investment requirement both upstream and downstream.

Given the nascency of the market, the average ticket size of deals in most sub-segments have been small. However, the average deal size is expected to increase as companies achieve scale and the market consolidates.

The sector is currently fragmented and will likely see consolidation in the coming years. It is critical for investors to identify companies that offer a unique value proposition, and show strong traction as they consider the expected performance of their investments in the sector which will benefit from companies’ ability to scale or be seen as a merger or acquisition target. As the sector matures, there will be a growing need for debt to further finance growth with a lower cost of capital, given the capital-intensive nature of the sector. Moreover, affordable debt for end-users will also be critical in increasing adoption of EVs. Targeted interventions such as risk sharing facilities can be utilized to reduce the hesitancy of traditional financiers in the space.

The large market size for EVs, as well as India’s position as a market leader in the overall automobile sector, makes the country well positioned to become a global leader and hub for EV investment.
CURRENT CONTEXT

GLOBAL SECTORAL TRENDS

Key Takeaways:
- The electric mobility sector has grown significantly since 2019, driven by policy support, and has displayed resilience despite the COVID-19 pandemic.
- Growth has so far been geographically concentrated in China, the US, and in Europe.
- An increased concern around supply chain concentration is a major opportunity for India to position itself as a potential hub for EV manufacturing.

The transport sector is responsible for approximately a quarter of the world’s greenhouse gas (GHG) emissions. The adoption of sustainable mobility solutions is essential to achieve the climate goals laid out in the Paris Agreement. Moreover, studies show that the sustainable mobility sector could also have a profound economic benefit given the lower total cost of ownership (TCO) over the life cycle of the vehicle.

The sector has exhibited resilience and displayed robust growth despite black-swan events such as the COVID-19 pandemic. The broader automobile sector was heavily impacted by declining consumer demand and supply chain constraints during the pandemic. The industry saw a nearly 15% decline in global car sales between 2019 and 2020 (IEA 2021). In contrast, EVs saw an unprecedented boom, with sales increasing by 43% during the same period (Virta 2022). The rise in EV sales also triggered the expansion of other segments of the e-mobility ecosystem, such as the charging infrastructure segment, which witnessed a growth of 40% from 2020 to 2021 leading to 1.8 million publicly available charging infrastructure points. Global battery demand also doubled from 2020 to 2021 to 340 GW (IEA 2022). Between 2022 and 2030, the market size of the e-mobility sector is predicted to grow at an average annual growth rate of 22.5%, reaching $1.1 trillion by 2030 (Globe Newswire 2022).

The success of the sector can be primarily attributed to sustained policy support from governments and regulatory bodies to meet global de-carbonization targets, alongside increased consumer awareness and environmental concerns. Government incentives have been widely successful in accelerating EV adoption in countries such as China, Norway, and Germany. On average, worldwide public spending on e-mobility adoption doubled from 2020 to 2021 to reach $30 billion, as many nations strive to meet ambitious targets to phase out internal combustion engine (ICE) vehicles in favor of EVs (IEA 2022). For example, the Government of the United States of America has allocated nearly $7.5 billion in 2021 to expand charging infrastructure within the country (Whitehouse 2021).

Further, policies set by regulatory bodies have encouraged many private sector players to adhere to de-carbonization goals. Some of the largest Original Equipment Manufacturers (OEMs) have set ambitious targets to increase the proportion of EV sales over the coming years.
Major corporations have also increased their commitments toward sustainable mobility. To showcase corporate leadership in the sector, a global platform known as EV100 has been set up by the Climate Group. The platform has 121 member organizations with a common goal of accelerating the e-mobility transition by adopting EVs for their owned and contracted fleets and setting up related infrastructure. This initiative has committed 5.5 million vehicles across 98 markets worldwide (EV100 2022).

Nearly 30% of all cleantech investments made worldwide in 2021 were in the electric mobility sector (Dawe 2022), making it a key focus area for investors globally. The sector has attracted over $62 billion of disclosed investment between 2010 and 2020 (McKinsey & Company 2021), and in 2021 alone, investment hit a new high of nearly $20 billion (Kunthara 2022).

**FIGURE 2: DISCLOSED DEALS AND EQUITY FUNDING (2015-2021)**
Private equity (PE) funds and venture capital firms (VC) have placed large bets leading nearly 93% of the investment into the sector (Kunthara 2022) indicative of the early stage of the sector. OEMs and auto industry incumbents have also invested heavily in the sector, with investments focused on in-house technology development and strategic collaborations. Since 2014, automakers have dedicated nearly $180 billion of their future technology development budget to electric vehicle development (McKinsey & Company, 2021) and they are poised to invest over $500 billion into environmentally friendly vehicles by 2030 (Hering 2021).

**FIGURE 3: GLOBAL AUTOMAKERS’ INVESTMENT COMMITMENT TO SUSTAINABLE MOBILITY BY 2030 ($B)**

![Bar chart showing automakers' commitment to next generation vehicles by 2030 ($B)]

Source: S&P Global

**Growth in the sector has been geographically concentrated.** Nearly 50% of the growth in the market has been driven by China, followed by the US and Europe (IEA 2021). Rapid growth in the Chinese market is a result of higher demand, availability of low-cost labor, and substantial policy support. Demand for EVs is high in China as prices are comparable to prices of conventional vehicles due to the lower cost of production. The sales-weighted median price of EVs was estimated to be just 10% more than conventional offerings, which is drastically lower than the worldwide industry average of approximately 50% (IEA 2022). Government incentives have ensured that the ecosystem has also developed at a rapid pace to accommodate the surge in EVs. The China Electric Vehicle Charging Infrastructure Promotion Alliance reported that a total of 1.5 million public charging stations had been installed as of May 2022 (DQ 2022). The United States and Europe (specifically Nordic countries and Germany) have also seen significant growth in the sector. A key driver of the growth of EV in Europe includes the implementation of stringent emission standards and policies.
As growth has been geographically concentrated, much of the supply chain has developed within these regions. Auto component manufacturing is led by German manufacturers such as Bosch and ZF. The battery manufacturing sector is almost completely dominated by Chinese manufacturers, as they produce nearly 80% of the world’s lithium-ion battery supply (Wired 2022). This geographical concentration of supply chains has affected the pricing and availability of components worldwide, making the industry more susceptible to supply chain-related risks.

**Investors have so far focused their investment into certain regions, limiting the development of a competitive global market.** Organizations based in China, Germany, and the United States have attracted significant capital, given the technological advances and potential for growth in the region. Investors have veered towards organizations that operate in the battery technology, mobility as a service (MaaS), EV charging and OEM segments of the value chain. Investment in the semiconductor industry has also grown significantly, in part due to the importance of the material in the EV value chain. In the decade preceding 2020, nearly $52 billion was invested in semiconductors, and this number is projected to grow to at least $500 billion over the next 10 years (CBInsights 2021).

**Major corporations such as Apple and Mazda have shifted their production facilities outside China due to the increasingly unstable geopolitical environment, cybersecurity issues and concerns around overdependence.** A similar trend can be seen in the e-mobility sector as many OEMs have begun to diversify their supply chains by adopting dual and multi-sourcing strategies (Morley and Monet 2022). Honda, who has had long-standing manufacturing facilities in China, is also planning to diversify their production away from the country (Gordon 2022).

**Localization of the supply chain is key to ensuring affordable unit economics and consequently faster end user uptake of e-mobility solutions.** Currently, battery accounts for approximately half of EV production costs (The Association for Manufacturing Technology 2022). Even in Europe where Poland and Hungary dominate the manufacturing market due to low labor costs, battery prices are on the higher side thereby impacting the overall unit economics. (Budapest Business Journal 2022). The continent is only able to cater to two-thirds of its growing battery demand of 52 GWh (Businesswire 2022), presenting an opportunity for new geographies to gain market share.

**Companies are now seeking alternative manufacturing hubs that are low-cost and regulation friendly.** This creates a high potential opportunity for India (The Economic Times 2022), and numerous countries already perceive India to be a frontrunner in this regard. Companies such as Brose, a European car component manufacturer that supplies to Honda, Ford and Nissan, doubled the size of its production unit in Pune, India. Hyundai is also deepening their capabilities in India to position India as a global hub for developing their small cars (Mint 2020). Other companies such as, Toyota-Tsusho and Sumida Corporation are considering a shift in manufacturing base from China to India due to the availability of affordable labor (Matthew 2020) and an encouraging policy environment which allows for 100% foreign direct investment (FDI).
The automobile industry is one of the main pillars of the Indian economy and contributes to over 7% of the country’s GDP. In 2022, India overtook Japan to become the third largest market for automobiles. The electric mobility sector has also witnessed substantial growth over the last five years, and the country is primed to become one of the largest EV markets in the world by 2030. The market is expected to grow at an average annual rate of 49% between 2021 and 2030 (India Energy Storage Alliance 2022). There are several factors driving demand for more economical and environmentally sustainable means of transportation such as:

Increasing concern around air quality: India is home to 35 of the 50 most polluted cities in the world (IQAir 2021). The transportation sector contributes to over 30% of GHG emissions in Delhi (Ramachandra, Aithal and Sreejitha 2015), and over 13% of all GHG emissions in the country (Climate Action Tracker 2020). Additionally, the sector contributes significantly to levels of pollutants such as PM 2.5, PM 10, and sulfur dioxide in the air. The alarming quality of air has encouraged many people to adopt sustainable options for mobility. A report published by the International Journal of Transportation Science and Technology, indicated 73.6% of the sample set quoted environmental reasons as a strong motivator to adopt EVs.

Rising fuel prices: The rising price of fuel is also driving interest in electric alternatives. Fuel prices in Mumbai, India have increased by nearly 30% between 2020 and 2022. Value-based purchasing habits of Indian consumers have organically increased the demand for more economical means of transportation. Moreover, given that India imports a majority of its crude oil, the government is pushing to electrify transport in the country to reduce its import bill.

Favorable policy environment: Subsidies and clean energy policies, at both the central and state government level, are also driving EV adoption within the country. The government has devised multiple schemes to encourage domestic manufacturing in the country, as well as demand side incentives such as direct subsidies to customers and reduced road taxes to accelerate EV penetration.

EV sales have grown at an annualized average rate of 55%. Sales in India are driven by the E2W and E3W segments. Between April 2022 and December 2022, E2Ws and E3Ws represented 62% and 34% of all EVs sales, while E4Ws comprised less than 4% of sales. E-bus sales stood at 0.19%, with 1,617 buses sold in the period of 9 months.
India is significantly different from the western EV market, specifically that of the United States and Germany, both of which are heavily dominated by E4Ws.

2-wheeler sales account for nearly 80% of all domestic vehicle sales in India (GIZ, NITI Aayog 2021). Scooters and motorbikes are the preferred choice of transport for most of the population in India given their affordability and ease of use. The intra-city use-case and lower total cost of ownership (TCO) in comparison to ICE vehicles of E2Ws and E3Ws make a strong case for the success of these segments in the Indian market (Avendus 2020). The FAME-II scheme has provided generous subsidies for E2W customers, reducing the cost of these vehicles by up to 20%, and thus making the adoption of E2Ws a more attractive proposition.

E3Ws are a popular option for last mile logistics and intra-city cargo. Given the high utilization factor of these vehicles, their TCO is comparable to that of ICE vehicles in a relatively shorter time period. Moreover, corporate commitments to sustainability have accelerated the adoption of these vehicles. A major E3W OEM interviewed for this report stated that this market growth is only restricted by supply.

The E4W segment has seen lower adoption rates in India. Currently, there are a limited, yet fast growing, number of options for passenger E4Ws available in India. These vehicles are priced at a premium compared to ICE vehicles. This high price has largely been attributed to the limited presence of domestic auto component manufacturers (GIZ, NITI Aayog 2021).

Though e-buses have so far seen the lowest adoption rates in the country, the Indian e-bus market is still amongst the largest globally. The Government of India is pushing to electrify public transport in the country and is seeking to deploy up to 50,000 buses in the next four to five years. Many State Transport Undertakings (STUs) have started replacing their existing ICE buses with e-buses which are being operated under a Gross Cost Contract (GCC) model wherein OEMs or operators are paid a fixed cost based on distance traveled.
POLICY AND INCENTIVE BEST PRACTICES

Key Takeaways:

- The Government of India has implemented many schemes to encourage the EV sector in India, including demand incentives under FAME, Production Linked Incentives for ACC batteries, and for automobiles and auto components.
- The upfront prices of EVs have been brought down considerably due to government subsidies at the central and state levels.

The Government of India has put in place multiple encouraging incentives and schemes to accelerate the adoption of EVs in India. These policies are not only reducing the end cost of EVs for consumers, but also supporting local manufacturing. Key policy highlights at the central level are illustrated in the figure below.

FIGURE 6: INDIAN EV POLICY HIGHLIGHTS

Source: Invest India

Union Budget 2023: The budget is expected to promote the sustainable mobility industry by making domestic EV manufacturing more competitive. Some highlights from the budget announcement include:

- Basic custom duty exemption on the import of machinery required to manufacturing lithium-ion batteries used in EVs as well as on auto-mobile parts and sub-systems
- Custom duty reduction from 21% to 13% on lithium-ion batteries
- Extension of concessional basic customs duties for EV/ hybrid batteries
- Additional budget allocation to support scrapping of old vehicles
- Emphasis on promoting the production of green hydrogen and biogas
FAME-II Scheme

The National Electric Mobility Mission Plan (NEMMP) 2020 was launched by the Government of India in 2013 to provide a vision & roadmap for faster adoption of EVs and manufacturing in the country. Under this plan, the Faster Adoption and Manufacturing of (Hybrid & Electric Vehicles (FAME) scheme was announced in 2015. The scheme has since been extended to 2024 with a $1.3 billion budget. The budget includes upfront incentives to reduce the purchase price of vehicles, as well as grants for setting up of charging stations.

The scheme has a large emphasis on providing economical & environment friendly public transportation options for the masses. However, as a mass component, privately owned registered E2Ws are covered under the program.

In 2021, the Ministry of Heavy Industries (MHI) made encouraging modifications to the FAME-II scheme. The subsidies for electric two-wheelers (E2W) were increased by 50% to INR 15,000 ($180) per kWh of battery capacity. The cap for this incentive was also increased from 20% to 40% of the ex-showroom price. Even prior to these revisions, TCO parity for both the 5- and 10-year periods had already been reached. The new incentives which include direct subsidies and a full road tax-waiver bring the E2W TCO below that of conventional models, presenting a very compelling case for EV adoption.

Production Linked Incentives (PLIs) for Advance Chemistry Cells (ACC)

The main implementing agencies for the PLI scheme are the MHI and NITI Aayog, the public policy think tank of the Government of India. The government has allocated approximately $2.5 billion to the incentive scheme which aims to build local manufacturing capacity of 50 GWh of ACC and 5 GWh of niche ACC capacity (planned). The scheme aims to result in economies of scale and increased exports, assisting major domestic and foreign manufacturers in establishing competitive ACC battery manufacturing in India. The government has signed agreements with three bidders, including Reliance New Energy Solar, Ola Electric, and Rajesh Exports for incentives under the scheme. The bids were assessed using a quality and cost-based selection mechanism.

- $5.5 billion of direct investment into ACC battery manufacturing projects
- Net savings of up to $30.5 billion on account of import bill reduction during the period of the scheme
- Incentive to encourage industry to promote fresh investments in indigenous supply chain and deep localization of the battery manufacturing industry
Production Linked Incentives (PLIs) for Automobiles and Auto Components

To improve India’s manufacturing capacity for cutting-edge automotive products, the MHI announced a PLI for Automobile and Auto Component Industry (“PLI Auto Scheme”) in 2021. The program offers financial incentives to promote domestic manufacturing and draw investments into the value chain of the automotive manufacturing industry. This scheme aims to overcome cost barriers and create a strong supply chain for products utilizing advanced automotive technology. Aside from commercial groups from India, approved applicants also came from Japan, Germany, the United States, the United Kingdom, the Republic of Korea, Ireland, France, Belgium, the Netherlands, and Italy. The enormous response demonstrates India’s strong potential to be a global manufacturing hub. A total of 85 applicants have been approved under this PLI scheme.

**FIGURE 9: EXPECTED IMPACT OF THE PLI SCHEME FOR AUTOMOBILES AND AUTO COMPONENTS**

- Direct investment of $8.1 billion into manufacturing projects
- Achieving incremental production of $28.4 billion
- Additional employment opportunity for 750,000 people

Source: Ministry of Heavy Industries

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India has other policies in place to encourage the e-mobility sector

**Battery Waste Management Rules**

To ensure environmentally appropriate treatment of battery waste, the Ministry of Environment, Forest, and Climate Change announced the Battery Waste Management Rules in 2022.

The regulations encourage the creation of new businesses and entrepreneurship in the collection, recycling, and repair of used batteries. By requiring a minimum level of material recovery from used batteries in the guidelines, new technologies, investments, and business opportunities will be brought to the recycling and refurbishment sector. Moreover, the rules will limit the amount of fresh raw materials that will be used in the production of new batteries, supporting the conservation of natural resources.

**Battery Swapping Policy (Draft)**

The draft battery swapping policy was launched by NITI Aayog to catalyze the large-scale adoption of EVs by improving efficient and effective use of resources (public funds, land, and raw materials for advanced cell batteries) for the delivery of customer centric services. EVs with swappable batteries are eligible for the same incentives as electric vehicles that have a fixed battery installed from the factory. According to the proposed policy, the magnitude of the incentive would be established depending on the kWh rating of the battery and compatible EV. The policy also mandates:

- A minimum contract period to ensure that battery providers continue to offer battery swapping services after receiving the subsidy
- Making public battery charging stations eligible for EV power connections at reduced rates
- Incorporating stations into current or upcoming time-of-day tariff regimes so that the interchangeable batteries can be charged during off-peak hours
- Installation of battery-swapping stations in sites including malls, general stores, public parking lots, and retail fuel outlets
State Level Policy Highlights

Central and State authorities, OEMs and other auto industry stakeholders are collaborating to develop an integrated strategy that will encourage the use of EVs and support India’s ambition for electric mobility. The government has taken action to ease FDI regulation in the sector. Foreign companies are able to establish their presence in India through subsidiaries, joint ventures, and limited liability partnerships. State-specific EV regulations could also accelerate India’s transition towards battery-powered transportation.

Demand-side incentives at the state level EV policies include:

- EV subsidies can be in the form of flat subsidies, a percentage of the EV price, or based on the vehicle battery capacity
- Tax incentives and exemptions on parking, roads, or vehicle purchase tax
- Designated EV zones
- Scrappage credits for disposing ICE vehicles in favor of EVs
- Non-fiscal incentives such as green registration plates and single window clearances

Innovation to cross-subsidize policy: Delhi’s EV policy has adopted the concept of “feebate” (i.e., by adopting measures by which inefficient or polluting vehicles incur a surcharge) to fund a high proportion of the demand incentives. The policy directs funding through sources like pollution cess, road tax, congestion tax, and other sources such as the environment compensation charge.

Supply-side incentives at the state level EV policies include:

- Subsidies on capital investment (e.g., fixed assets, land, charging stations)
- Industrial development capital subsidies to encourage local investment and mitigate expensive up-front development costs
- Land development incentives including land subsidies and exemptions on various fees, encouraging the establishment of EV industrial parks (e.g., Telangana, Tamil Nadu)
- State GST tax exemptions and interest subsidies on loans
- R&D incentives such as the construction of centers of excellence, industry – academia partnerships, and incubators to foster innovation (e.g., T-hub in Telangana)
- Training and reskilling compensation for employees and career development programs
Global Best Practices

Stakeholders through the value chain have echoed positive sentiments around the design of India’s policy. Countries such as Norway, South Korea, the United Kingdom, and Canada have also implemented various measures to encourage the sector in their respective countries. The most successful policy designs set clear targets for EV adoption with a well-defined roadmap to achieving their targets. Moreover, incentives that are designed to be easily accessible and administered at a sub-national level seem to accelerate adoption (NITI Aayog n.d.).

FIGURE 10: EV POLICY HIGHLIGHTS IN CANADA, UNITED KINGDOM, NORWAY, AND SOUTH KOREA

International EV Policy Best Practices

Canada:
• Rebates on after-tax cost of an eligible EV
• Rebates to businesses and governments for new EV charging stations

United Kingdom:
• EV charging point grant
• Favorable company car rates and tax benefits for EV
• Free or discounted parking
• Exemption from vehicle excise duty

Norway:
• Registration tax exemption
• No charge on toll roads
• Exemption from VAT on purchase of EV

South Korea:
• One-time purchase subsidy for EVs
• Planned reduction in purchase tax surcharge of EVs

Source: e-AMRIT, NITI Aayog
INVESTMENT LANDSCAPE OF INDIAN E-MOBILITY MARKET
CHALLENGES AND OPPORTUNITIES IN THE INDIAN E-MOBILITY SECTOR

Key Takeaways:

Investment constraints:
• Difficulty in identifying high-quality opportunities
• Need for patient capital
• Complexity in valuing company assets

End-user financing constraints:
• High upfront cost of EVs
• Lack of attractive financing options
• High insurance costs

Inadequate infrastructure constraints:
• Inadequate electrical supply network
• Limited charging infrastructure
• High cost of batteries

The Government of India’s encouraging policies have enabled EV penetration in the country over the last decade, but widespread adoption has remained limited—only 4.7% of all vehicle sales in 2022 were EVs (CNBC TV18 2022). Challenges in achieving India’s 2030 target of 30% EV penetration remain. These challenges include a lack of access to finance, both for companies operating in the sector and for end-users, and inadequate market enabling infrastructure. For India to reach its EV target, the e-mobility sector is estimated to require an investment of at least $192 billion (CEEW CEF 2020).

INVESTMENT GAPS

There are challenges in identifying high-quality opportunities: The trajectory of India’s e-mobility sector growth is highly dependent on the accessibility of finance for players across the value chain. However, information asymmetry between investors and investees resulting from the nascency of the sector has limited investment into innovative companies. According to data from Unitus Capital, 33% of a sample set of climate financiers believe insufficient knowledge to be a challenge to invest in the sector. Investors are unable to fully understand the technology behind electric mobility and are hence unable to identify high-quality investment opportunities in the space, limiting the perceived deal flow and pipeline. According to an ecosystem player, “It is very difficult for investors to separate the noise from the signal in this space.”

Large OEMs are currently waiting for players in the ecosystem to burn their fingers before placing bets on players in this space.

- Spokesperson, EV Leasing Company
There is a strong need for patient capital: Considering the nascent stage of the sector, patient capital is the key to ensuring the growth of the sector. The e-mobility sector needs an approach similar to that of the defense and aerospace industry where investors are willing to provide patient capital to companies and place utmost importance on innovation and reliability.

The founder of a high-performance EV and battery solution provider suggested that OEMs need investors who are willing to invest for a longer time horizon. In her words, “safety and reliability are non-negotiable for vehicles,” and investors need to keep in mind that new OEMs need considerable time to develop and release high quality vehicles to the market.

Many investors have been hesitant to invest in this sector caused by higher perceived risk due to evolving technology and pressure on returns due to a longer investment horizon.

There is considerable complexity in valuing company assets: The cost of capital in the sector is very high as there is significant uncertainty around the useful life of EVs and their components. Investors perceive this space to be risky as they are unable to ascertain the value of company assets. There is little clarity around the salvage value of components and an almost non-existent secondary market for EVs and EV components. Most EVs have not yet completed their useful life, and financiers are struggling to accurately predict this, especially in India where equipment is operated in climate and road conditions extremely different from standard testing conditions. Many companies in the Indian e-mobility sector have begun integrating IoT sensors in their products to help predict the useful life of their EVs. The data from these sensors is, however, kept within the company, making it hard for any stakeholder in the ecosystem to make accurate assumptions while valuing assets.

The current macroeconomic environment is not conducive to investments: Interest rate hikes across the globe have reduced investors’ appetite for investment. This holds true in India as well, where the central bank has increased its interest rate by 225 basis points over seven months to 6.25% in December 2022. Start-ups have recognized that, despite interest in the sector, current macroeconomic conditions are not conducive to fundraising. During an interview, the CEO of a charging point designing and operating company expressed his pessimism about attracting funding during this period, given the “dry global funding spell.”

END USER FINANCING CONSTRAINTS

The upfront cost of EVs is still high: Through subsidies, lower tax rates, and reduced registration costs, the Government of India has reduced the price of electric vehicles, with the goal of increasing uptake. However, the upfront cost of EVs, especially of larger vehicles, is still higher than that of their ICE counterparts. The high prices of EVs can be attributed to the cost of batteries and cell components, as well as the cost of R&D to develop the sophisticated technologies that are integrated into the vehicles. Price remains as one of the key barriers to uptake, especially for personal use vehicles. The price of E2Ws is usually over 50% more expensive than their ICE counterparts (International Council of Clean Transportation 2021). Most EVs in the E4W segment are manufactured by large auto industry incumbents, and only a few models are currently on sale in the country. Even the Tata Nexon, a relatively affordable EV model, is almost 1.5 times the price of its ICE counterpart (E-Vehicle Info 2022).

The TCO for E2Ws and E3Ws is now lower than or equal to that of ICE vehicles, with rising fuel prices across the world contributing to TCO parity. The electric 4-wheeler segment still lags in this regard. 4-wheelers only achieve a reasonable TCO when vehicle utilization is over 150 km a day (Dr. Parveen Kumar 2020), making them ideal for taxi aggregators and corporate transport vehicles.

Investors are willing to pay a premium on EV investments but are waiting to see the how the market progresses before they invest.

- Investor Relations Lead, E-Motorcycle OEM
End user uptake is limited by lack of financing options and unconducive financing terms:
More than three-quarters of all vehicles sold in India are financed through credit, and loans for electric vehicles comprise of a mere 1% of all of India’s vehicular loans (Amit Bhatt 2021). Very few banks are participating in the sector in India with the State Bank of India being the primary lender in this market with its Green Car Loan. Most banks do not have a specialized product tailored to the sector, except in the e-rikshaw segment where financial institutions such as IndusInd Bank and Punjab National Bank have created dedicated products catering to this segment.

Moreover, domestic interest rates in the sector are higher compared to ICE vehicles. This is primarily because of-

- **Technology risk**: EVs are yet to create a proven track record and demonstrate certainty around the useful life and resale value. Some new OEMs are addressing this concern with plans to buy back their vehicles at a pre-defined price. Such buyback programs may help catalyze the secondary market for EVs and help enhance the residual value for EVs.

- **Higher perceived risk of borrowers especially in the E2W/E3W space**: Most of the customers purchasing electric 2-wheelers and 3-wheelers have limited formal credit history and require significant handholding support to access the available sources of finance. For example, the CEO of a non-banking financing company (NBFC) serving the e-mobility sector mentioned that many of their customers required support in opening their bank accounts in order to avail loan products.

Interest rates vary significantly according to customer type and vehicle type. In an interview, the founder of an EV leasing platform described the cost of capital for the 2-wheeler and 3-wheeler segment as “very high – ranging from 35% for drivers and 18% for fleet owners.” He also emphasized the need to unlock low-cost capital to catalyze the growth of this sector. According to another interview with a provider of mobility as a service, the cost of capital ranges from 18-22%.

As such, there is considerable disparity in terms of credit within the ecosystem. Lenders are more comfortable extending credit to E4W customers and do so at a rate closer to that for ICE vehicles – approximately 8-9%. They are also comfortable financing almost the total cost of the vehicles. On the other hand, interest rates for E2W/E3W customers are considerably higher, usually upwards of 18%.

Financiers also provide a considerably lower loan to value ratio for these vehicles and keep the loan
A vehicle aggregator interviewed highlighted that commercial EVs have short loan tenures of three years, while that of ICE vehicles is eight years. Shorter repayment periods translate to high equated monthly installments making these loans significantly more expensive for end users. The company added that a risk mitigation facility such as a first loss default guarantee would reduce the risk of lending for NBFCs and unlock greater capital in the sector.

Insurance costs are also significantly high in the sector: In addition to paying a higher upfront amount for EVs, customers also pay higher insurance premiums. During an interview, a provider of an e-mobility technology platform emphasized how insurance remains a problem for the sector due to the high premiums being charged. EVs contain sophisticated technology such as lithium-ion batteries, IoT devices, etc. that require high-skilled mechanics for servicing. Due to the limited number of EVs in India, the number of skilled EV mechanics is considerably lower than that of ICE vehicle mechanics. This results in a significantly higher repair cost. Additionally, though EVs contain fewer parts than their ICE counterparts, their components are considerably more expensive given their advanced technology. Moreover, these parts are not yet easily available in India, and often must be imported resulting in high replacement costs.

INFRASTRUCTURE LIMITATIONS

Inadequate electrical supply network: India has made large strides in increasing its energy capacity; however, the nation still has a peak power deficit as of December 2022. With an increase in EV adoption and hence the use of charging infrastructure, there will also be a rapid increase in the load on the electricity grid. The total electricity demand to power EVs is estimated to reach 69.6 TWh by 2030 (ETAuto 2018). It is critical to factor in this increase in demand while planning the electricity network. India already suffers from voltage fluctuations, and increased demand on the grid can lead to further voltage stability issues. Smart demand management systems can be used to minimize overloading the grid, and to procure electricity at low rates on energy exchanges by aggregating electricity demand.

Limited charging infrastructure: The Ministry of Power has proposed that charging stations should exist within an area of 3x3 km to boost the confidence of EV users. It is estimated that India would need a system of almost 3 million chargers to realize India’s 2030 goal. There is an investment opportunity of $2.9 billion for public charging infrastructure deployment to reach India’s EV target (CEEW CEF 2020).
The “chicken-and-egg” conundrum for EV uptake and charging infrastructure was the most widely cited explanation for limited EV penetration in India. Consumers are hesitant to purchase electric vehicles due to range anxiety as they are afraid their EVs will not have adequate charge to reach their destination and charging point operators are cautious about installing chargers because of the limited demand. Though captive charging stations reach high utilization rates, public charging infrastructure utilization rates are as low as 6% according to some public charging point operators. In an interview, a spokesperson for a charging point operator suggested that the payback period for a charging station is 5 to 7 years, which makes for an uncompelling business case. Charging point operators are teaming up with fleet aggregators to identify EV hotspots to set up chargers in the most favorable locations.

### High cost of batteries

Though the price of lithium-ion batteries has fallen by 97% over the last three decades (Our World in Data 2021), batteries are still the most expensive component of electric vehicles, making up between 50-70% of the vehicle’s cost. In 2022, battery prices for electric vehicles in particular climbed for the first time in at least 12 years to $138/kWh due to the increased prices of Lithium, Nickel, and other metals. BloombergNEF predicts that the premium for EVs will disappear once battery prices fall to $100/kWh – a tipping point which is now forecast for 2026.

Raw material, which includes metals such as Lithium, Cobalt, and Nickel, accounts for over half of the total cost of battery packs. In order to bring the overall cost of EVs down, a strong supply chain of these raw materials is required. India has scarce reserves of these metals (World Resources Institute 2022), and hence processing and recycling these materials will be critical. The Government of India has been rolling out incentives to boost battery manufacturing and localize the production of key components like advanced cell chemistry battery storage through PLI schemes. According to a study by Arthur D Little, India will need 800 GWh of batteries to achieve its 2030 goal. India will require more than $10 billion of investment focused into battery manufacturing to meet this demand.
INVESTMENT SUPPLY

INVESTMENT LANDSCAPE OF INDIAN E-MOBILITY MARKET

SUPPLY OF CAPITAL IN THE E-MOBILITY SECTOR

Key Takeaways:

• The sub-sectors that have received the most significant amount of funding in India have been OEMs, charging infrastructure, and MaaS.
• Investment into battery manufacturing and technology segment has been growing, in part due to supportive government policy
• Investment into the auto component sector has been limited, but investors are coming to realize the importance of good engineering, as EV technology matures
• In addition to companies with scale and strategic partnerships, companies that focus on customization, localization, and capturing the entire value chain are particularly attractive to investors.

Despite challenges in the ecosystem, the electric mobility sector in India has grown exponentially over the last few years. The sector can be divided into 6 major categories. The figure below illustrates players active in each of these categories.

FIGURE 13: MARKET MAP OF THE INDIAN E-MOBILITY SECTOR

Source: Primary Research
Early investments in the e-mobility sector were driven by relatively risk-averse investors contributing relatively small tickets, with PE and VC investment into the sector standing at just $13 million in 2015. Despite the economic slowdown of 2022, investment into the Indian EV sector hit $906 million, with companies securing ticket sizes as big as $150 million (Finetrain 2022).

Large investors such as development finance institutions (DFIs) are making significant investments into the space, mostly to reduce the cost of capital in the sector. As detailed in earlier sections of the report, traditional financiers are reluctant to lend to the sector. Interest rates from NBFCs and venture debt funds are high, with the return expectations of these investors ranging from 16-18%. DFIs and other concessional capital providers have been active in the Indian e-mobility sector. Green Climate Fund, for example, has partnered with The Macquarie Group to establish a platform aimed primarily at reducing the high upfront cost of EVs.

### Fund Snapshot: EV Leasing and Financing Facility

The Macquarie Group is leading the development of a blended finance platform, with UN’s Green Climate Fund (GCF). It is launching a “first-of-its-kind” financing facility for the Indian e-mobility sector, with the goal to mobilise at least USD 2.1 Billion.

<table>
<thead>
<tr>
<th>Target Size</th>
<th>USD 1.5 B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruments</td>
<td>Debt</td>
</tr>
<tr>
<td>Investor</td>
<td>GCF - USD 200 M</td>
</tr>
<tr>
<td>Legal Entity</td>
<td>NBFC</td>
</tr>
<tr>
<td>Implementation Period</td>
<td>10 years</td>
</tr>
<tr>
<td>Product offering</td>
<td>Operating and finance leases and other structured credit solutions</td>
</tr>
</tbody>
</table>
Similar to other countries, OEMs in India are predominantly focused on investing in R&D to expand their own EV offering. For example, Mahindra & Mahindra announced a ramp-up of investments in the EV sector of approximately $400 million. TVS motors, another major OEM, also announced a fundraise of roughly $200-400 million to fund their expansion into the sector. Some large corporates are investing in start-ups either to accelerate development in the sector or to leverage innovative start-up technologies through strategic partnerships. For example, Bajaj Auto has invested in Yulu, an electric bike manufacturer, and Amara Raja, one of India’s biggest battery manufacturers has invested in Log9, a start-up working on new battery technologies.

Given the significant capital needs of this nascent sector, the Government of India has been proactive in developing PLI schemes and allowing for 100% FDI to increase both domestic and foreign investment. The Indian ecosystem has adapted significantly to become more attractive to investors and has experienced a boom in FDI inflows. The e-mobility industry attracted nearly 6% of all FDI ($32 billion) between 2000 – 2022, a significant portion of which came after 2015 as the industry started to boom. Roughly 20% of the investment ($6 billion) was invested in 2021 alone (Lohia 2022).

As the Indian sector is driven by startups, PE and VC firms have contributed to a significant portion of the growth. Their investment in the sector has increased progressively as the ecosystem has developed. **Most PE and VC investors prefer focusing their investment into business models which provide commercial returns (at least 16-18%).** The climate positive impact is of secondary importance to traditional PE and VCs. Impact focused investors, however, are willing to accept slightly lower returns for a reduction in emissions, increased access to mobility, or innovation.

**SECTOR-WISE BREAKDOWN OF INVESTMENT**

![Figure 15: PE/VC Investment Across Different Segments ($M)](source: Electrifying Indian Mobility, EY Parthenon (2022))
OEMs have received the lion's share of funding with investments concentrated amongst industry incumbents and a handful of start-ups. OEMs have a larger capital requirement given the capital-intensive nature of the business and are the first to scale production as market demand increases. Industry incumbents have raised large investments to increase the scale and production capacity of their e-mobility business. Tata Motors, Hyundai, and Mahindra received over 60% of all FDI into the Indian EV market in 2021 (ETAuto 2022).

Startups in the sector have also raised significant capital to develop vehicles that are cost-effective, reliable, and safe. PEs and VCs invested almost $982 million in EV OEMs through 25 deals in the first 10 months of 2022 (Autocar Professional 2022). Ather Energy, an E2W OEM, received an investment of $165 million from investors such as Hero MotorCorp, National Investment and Infrastructure Fund, GIC, and Tiger Global Management. However, FDI into startups has been concentrated amongst 5-6 large players. Smaller and relatively newer organizations struggle with accessing finance given the size of their balance sheets and uncertainty around cash flows. During an interview, the founder of an EV leasing company stated that OEM start-ups fall into a trap since they do not have enough capital to raise debt, and because of the unavailability of debt they are unable to scale and attract equity capital.

Charging infrastructure and battery swapping have attracted considerable capital due to their value proposition and potential to scale. Adequate charging infrastructure, which includes slow chargers, fast chargers, and battery swapping facilities, is critical in driving EV adoption. Investors have recognized the need to invest in this segment as range anxiety is one of the most cited barriers to EV adoption. Companies that have been offering assured revenue streams by providing captive charging stations or battery swapping infrastructure are attracting significant investment. Start-ups such as Magenta, ElectriVa, Bolt, and BatterySmart have cumulatively received over $90 million in disclosed investments to expand their networks (Pitchbook 2022).

Investment into Mobility as a Service has picked up due to their potential to generate recurring sources of revenue with limited asset requirements. Investors appear more comfortable supporting companies that offer MaaS as these businesses cater to the high demand and are able to make use of EVs while avoiding their high upfront cost. These business models are perceived to be relatively less risky as they have recurring sources of revenues through contracts and subscriptions to back the commercial viability. This subsector has seen investment from PE funds, with Eversource Capital acquiring a majority stake in Lithium Urban Technologies. Start-ups such as Yulu and MoEVing have also attracted significant capital from investors.

Battery development and manufacturing have so far seen relatively limited investment given the limited access to raw material. The sector is increasingly seeing investor interest as technology-forward business models emerge in the sector, including innovative new chemistries customized to Indian conditions and those companies looking at developing a domestic supply chain for cell components. This includes companies operating in the ‘urban mining’ or battery recycling sector, as this can decrease India’s raw material import dependency significantly.

Component manufacturing companies and those working on telematics and other “unglamorous” segments of the value chain have seen lesser investor interest. The CEO of an EV component manufacturing company explained that it took his firm over a year to complete its initial fundraiser as most investors were only interested in OEMs, because of their significant marketing and branding efforts. However, this is changing, and ecosystem players believe that investors have now begun to realize that the technology behind EVs is the critical lever of the success of this sector.
CHARACTERISTICS OF HIGH-POTENTIAL INVESTMENT OPPORTUNITIES

In addition to companies with scale and strategic partnerships, companies that are getting significant investor interest are those who operate based on the following pillars:

Customization – EVs and EV components need to be customized to Indian conditions and habits to ensure safety and reliability of vehicles. Indian climate conditions are extreme – temperatures range from low single digits in the winter, to almost 50°C in the summer. EVs operate optimally at 21.5°C (Geotab n.d.), which is far from the average temperature in most regions of India. Given the heightened concerns around safety from the many EV battery fires that took place in the summer of 2022, there has been renewed focus on ensuring that EVs are built for Indian conditions. Policy is now being geared towards ensuring that battery manufacturers design their products to fit with specific performance standards.

Indian roads are also different from roads in the West and are often poor and require a ‘start-stop’ driving style. EV OEMs that design their vehicles keeping road conditions in mind and ensure rigorous on-road testing and validation have seen increased uptake of their product.

Vehicles also need to be innovatively designed keeping in mind the end-consumer. 96% of EVs sold in India in 2022 were either 2-wheelers or 3-wheelers. OEMs in these segments are working closely with fleet operators to customize vehicles as per their requirements. Users of these products are extremely price sensitive (Catapult 2021). Telematics and IoT help ensure that vehicle usage is customized to extend the life of EVs so that the TCO to consumers is as low as possible.

Value chain integration – The CEO of a charge point aggregating company suggested that players that are operating across multiple sub-sectors have the best scope for investment. Tata Motors for example, is working on both EV manufacturing and charging infrastructure. Based on conversations with stakeholders, it is evident that many companies that follow this approach have attracted considerable investments. Some of the leading MaaS providers also provide charging infrastructure for riders (in case their customers are fleet operators), and prominent charging infrastructure providers pair their services with telematics. Major OEMs interviewed indicated that they were looking to vertically integrate their battery manufacturing units as a high dependence on foreign players for raw material import threatens profitability.
Indigenization – Most ecosystem players reported limited challenges in their supply chain, barring those around battery packs. OEMs have diversified their supply chain to 2-3 suppliers in order to hedge risks of supply shortages. Battery prices rose 7% in 2022 (BloombergNEF 2022), with the increase being attributed to soaring prices of battery materials, rising inflation, and supply chain disruptions arising from continuing lockdowns in China as well as from the war in Ukraine.

India is highly dependent on imports for battery material, cell manufacturing, and component manufacturing. Most OEMs indicated that their components were sourced from global players such as Mahle and Bosch who have set up domestic manufacturing plants. There is a high growth potential for firms that are producing components for EVs domestically, as the Government of India has proposed financial incentives to boost domestic manufacturing and attract investment through a PLI for auto components.

The Indian battery sector is dominated by large corporates such as Amara Raja and Exide. However, the sector has also witnessed the growth of domestic start-ups working on innovative new battery chemistries to build batteries for the Indian market that are more efficient and safer.

As the supply of raw material for batteries is heavily import dependent, the Government of India is pushing to localize battery production through a PLI for cells. Very few companies can produce cathode and anode material, and the industry in general is dependent on China for this raw material. Battery recycling companies have a key role to play to address this gap, as they can recover valuable metals and repurposing them for second use.
INVESTMENT LANDSCAPE OF INDIAN E-MOBILITY MARKET

DEMAND FOR CAPITAL IN THE E-MOBILITY SECTOR

**Key Takeaways:**
- The electric mobility sector represents an investment need, and therefore opportunity, of over $200 billion till 2030
- The EV market is still nascent in India with ticket sizes of deals in the sector expected to grow as the market consolidates and companies achieve scale
- Debt is likely to become increasingly important for increased EV adoption and companies to be able to scale

The number of electric vehicles sold in India almost reached 1 million in 2022, a 208% increase from the previous year (Autocar Professional 2022). This growth has been fueled by increased investment in the sector, especially in the OEM, charging infrastructure, and MaaS sub-sectors, given the number of players in the market.

Every segment of the value chain will require substantial investment to achieve the ambitious targets set out by the Government of India. The total investment required by 2030 in the vehicle manufacturing sector alone is $178 billion, followed by $12.3 billion in battery manufacturing (if battery suppliers are to achieve 100% indigenization) and finally, $2.9 billion in investment into the charging infrastructure ecosystem (CEEW CEF 2020).

**OEM**

There is $178 billion investment opportunity in the EV OEM sector. The table below details the number of vehicles that will be required to meet India’s 2030 target of 30% EV penetration, as well as the associated investment that will be required from OEMs to meet these goals. The E2W segment requires the most investment (despite the low cost of production per vehicle) because of the volume of vehicles that are demanded in the market.

<table>
<thead>
<tr>
<th>EV Category</th>
<th>Vehicle Sales (in million)</th>
<th>Total production costs for OEMs (in $ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars (private)</td>
<td>3.1</td>
<td>48</td>
</tr>
<tr>
<td>Cars (commercial)</td>
<td>2.2</td>
<td>26</td>
</tr>
<tr>
<td>Buses</td>
<td>0.1</td>
<td>8</td>
</tr>
<tr>
<td>Three-wheelers</td>
<td>2.6</td>
<td>5</td>
</tr>
<tr>
<td>Two-wheelers</td>
<td>93.7</td>
<td>91</td>
</tr>
</tbody>
</table>

Source: CEEW CEF’s Financing India’s Transition to Electric Vehicles Report (CEEW 2020)
**Sectoral Characteristics**

- The E2W segment is led by start-ups, comprising 7 out of top 10 selling E2Ws in 2022 (Autocar Professional 2022).
- There is a lower barrier to entry due to the availability of a mass market, policy support and favorable economics.
- There are over 20 OEMs in the segment and the market is fragmented.

As the sector consolidates and large incumbents enter the market, investors can expect potential exit opportunities, both strategic and financial.

While the production costs for E2Ws are lower than other segments, the investment requirement of the sector is similar to that of cars given the volume of E2Ws in India.

**By 2030, an estimated $91 billion is required in just production expenses.**

- The demand in the E3W segment is driven by commercial demand. Due to their lower TCO in comparison to ICE vehicles for long distances, they are often used for last-mile delivery.
- The segment has seen the greatest uptake, with the EV proportion touching 56% in May 2022 (Mobility Outlook 2022).
- Like the E2W segment, the E3W segment is fragmented with both start-ups and incumbents in the space.

As the sector consolidates and large incumbents enter the market, investors can expect potential exit opportunities, both strategic and financial.

The 3-wheeler segment can be expected to achieve maturity sooner than the E2W due to the high uptake and substantially smaller market size.

This relatively small market size and low production costs result in an investment requirement of $5 billion by 2030.

**TABLE 2: VC & PE INVESTMENT IN THE E2W AND E3W IN THE PERIOD BETWEEN 2017 TO Q3 OF 2022**

<table>
<thead>
<tr>
<th>Category</th>
<th>Average ticket size ($ million)</th>
<th>Number of deals</th>
<th>Cumulative funding ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E2W</td>
<td>19</td>
<td>82</td>
<td>1,584</td>
</tr>
<tr>
<td>E3W</td>
<td>6.3</td>
<td>13</td>
<td>82.6</td>
</tr>
</tbody>
</table>

Source: Tracxn

The E2W segment has seen considerable interest given the demand for two-wheelers in India. This is also evident from the volume of deals that have happened in the sector in the last five years. The large average ticket size indicates that companies in the sub-segment are maturing. This subsector is likely to see consolidation in the near-term as clear market leaders emerge in the segment.
Sectoral Characteristics

- **E4Ws have had a relatively low uptake in India**, partially due to the high upfront cost of these EVs.
- The market is led by legacy players such as Hyundai, Mahindra, Tata etc. and some players have set-up dedicated EV subsidiaries.
- They have typically financed their EV projects from their own balance sheet, or raised finance from external investors for their EV subsidiaries at a corporate level.
- For Example, Mahindra & Mahindra recently invested $250M of its own money and raised $250M from BII for its EV subsidiary.

As the upfront cost of E4Ws reduces, and charging infrastructure becomes omnipresent, there will be a greater uptake of these vehicles.

This segment will require **$74 billion of investment to meet India’s 2030 target**. Though the number of vehicles required is approximately only 5 million (compared to almost 94 million E2Ws), the large quantum of investment can be attributed to the capital-intensive nature of E4W manufacturing.

While a substantial portion of required investment is likely to be provided from OEMs themselves, **some OEMs will look to raise finance on a corporate level for their EV subsidiaries**. This could represent an attractive opportunity for climate and impact focused investors.

- Demand in the e-bus sector is largely driven by STUs.
- Like the E4W sector, it is dominated by legacy players such as Ashok Leyland (under Switch Mobility) and Tata.
- Some of these players have launched dedicated wholly owned EV subsidiaries as well.

**E-bus players are attractive to investors looking for low-risk and infrastructure-like investments.** As most e-buses operate under GCC contracts from STUs, there is a stable source of revenue and hence a lower risk associated with investing in the bus sector.

### CHARGING INFRASTRUCTURE

There is a **$2.9 billion investment opportunity to build charging infrastructure** to adequately cater to the Government of India’s 2030 EV target. Charging infrastructure, including battery swapping, requires patient capital due to its long-term value proposition. Charging infrastructure for fleets or areas such as residential and corporate areas in urban centers in which there is assured demand is especially attractive as they ensure high utilization rates.
**Sectoral Context**

- **This sector requires investment for the EV ecosystem to flourish.** Range anxiety has been cited as one of the most common barriers to uptake of EVs. Increase in charging infrastructure should help address this concern which is expected to increase adoption of EVs.
- **The subsector sees participation from a wide range of stakeholders,** including start-ups, OEMs, energy service providers, large corporates, and industry and oil giants. Joint partnerships have been formed between large corporates such as Tata Power and Hyundai to set up more infrastructure. Corporates also partner with existing CPOs to set up infrastructure.
- **Battery Swapping sector** is promising as it allows vehicles to **minimize downtime** which is especially beneficial to commercial players. However, the lack of standardization of batteries has led to an interoperability issue. Nevertheless, the sector shows promise, and is further encouraged by the draft battery swapping policy released by NITI Aayog in 2022.

**Investment Outlook**

Considering the nature of EV charging stations, **patient capital is necessary. These services have the potential to create long-term returns.**

In the short-term **integrated models that cater to captive demand**, such as chargers for fleet operators, have been successful in generating returns. The battery swapping sector in particular shows high potential. The government is in the process of ratifying the draft **battery swapping policy, which might address battery standardization related concerns.** Further, according to key stakeholders, it reportedly suffers from **fewer demand related constraints.** In the short-term, its integration with battery-as-a-service models also has the potential to make EVs more affordable to end users, as batteries can cost as much as 50% of the total vehicle.

**TABLE 3: VC & PE INVESTMENT IN THE CHARGING INFRASTRUCTURE SEGMENT IN THE PERIOD BETWEEN 2017 TO Q3 OF 2022**

<table>
<thead>
<tr>
<th>Category</th>
<th>Average ticket size ($ million)</th>
<th>Number of deals</th>
<th>Cumulative funding ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charging Infrastructure</td>
<td>3.8</td>
<td>117</td>
<td>441</td>
</tr>
</tbody>
</table>

*Source: Tracxn*

This segment has seen many deals over the last year, as having charging infrastructure in place is critical for the growth of the sector. The relatively small average deal size indicates that these players are currently in early stages. Though the market is currently fragmented, companies are starting to achieve scale. The market could consolidate in the coming years given the potential for economies of scale in the sector.

**Mobility as a Service (MaaS)**

The MaaS sector will continue to grow as fleet operators electrify their fleets given the attractive TCO economics of EVs for last mile delivery.
INVESTMENT LANDSCAPE OF INDIAN E-MOBILITY MARKET

**Sectoral Context**

- MaaS has a **strong value proposition** to e-commerce and delivery companies, and other fleet operators.
- Major delivery businesses such as Amazon, Flipkart, and BigBasket have announced their intention to convert their fleets to EVs. MaaS for corporate employee transportation has also gained traction, with companies such as JSW Steel and BNY Mellon introducing EV fleet services for their employees.

**Investment Outlook**

Investors can expect greater assurance and transparency around cashflows in this segment due to **contract-based revenue models**.

The capital required for this sector to grow is significant as fleets require replacement and maintenance due to the relatively short battery life span of the vehicle.

**TABLE 4: VC & PE INVESTMENT IN THE MAAS SEGMENT IN THE PERIOD BETWEEN 2017 TO Q3 OF 2022**

<table>
<thead>
<tr>
<th>Category</th>
<th>Average ticket size ($ million)</th>
<th>Number of deals</th>
<th>Cumulative funding ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility as a Service</td>
<td>5.5</td>
<td>65</td>
<td>360</td>
</tr>
</tbody>
</table>

Source: Tracxn

The MaaS sector is attractive to investors as these providers have long-term commitments from customers and asset utilization is high. Emerging business models such as monthly subscriptions, GCC models, and on-demand services have expanded in the recent years. Significant investment is likely to be required for MaaS providers to scale their fleets.

**AUTO COMPONENTS**

**Sectoral Context**

- OEMs in the EV space are looking to enable domestic electric component manufacturing in India to become globally competitive.
- Indian companies are well placed to capture opportunities in auto component manufacturing, as India already has a competitive advantage in the sector. Forging, castings, and gear box parts, are some of the categories in which Indian players can expand their existing component manufacturing capabilities. (McKinsey & Company 2022).

**Investment Outlook**

Industry incumbents are well placed to invest in EV components and battery technology even though these components differ significantly from ICE vehicle components. Component manufacturers are increasing their exposure to electric components and reducing their ICE vehicle exposure.

This segment provides an attractive opportunity as it is expected to grow significantly, driven by the government’s policy which **incentivizes the localization of auto components**.

According to the Automotive Component Manufacturers Association of India’s estimates, the sector provides an opportunity of $20 billion in the next five years. (Economic Times 2022).
The sector has so far primarily been funded by equity, which has a high cost of capital. As the electric mobility sector matures, there will likely be a greater need for debt to fund growth, especially due to the capital-intensive nature of the sector. Currently, traditional financiers are struggling to evaluate asset depreciation and the resale market in the EV sector, and hence, are hesitant to lend to the sector. Given trends in the traditional automobile sector and the average income level in India, it is likely that the end-user of EVs will require financing for EV uptake. Debt will first need to be raised at a corporate level for OEMs to reduce their overall cost of capital before being able to offer a financed solution to individuals.

Initiatives such as GuarantCo & Axis Bank’s guarantee facility and the World Bank, SIDBI, and the Government of India’s EV financing facility aim to enable traditional financiers to take on greater risk and hence increase access to credit in the sector. Complementary technical assistance programs could also be developed to encourage traditional financiers to utilize these facilities and deploy capital. As EVs begin to form a larger proportion of overall vehicle sales and their technology becomes better understood, debt will become a greater part of the sector’s capital requirement.

New EV-focused initiatives in India are focused on providing lower-cost capital through risk-sharing facilities

**SIDBI, World Bank and GOI EV financing facility**

<table>
<thead>
<tr>
<th>Amount</th>
<th>Instrument Type</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>$125M</td>
<td>Partial Credit Guarantee (upto 40%)</td>
<td>Guarantee for Portfolio of EV Loans</td>
</tr>
<tr>
<td>$125M</td>
<td>Concessional Debt</td>
<td>Concessional capital to on-lend to borrowers</td>
</tr>
</tbody>
</table>

**GuarantCo and Axis Bank Guarantee Facility**

GuarantCo and Axis Bank have announced the intent to execute an umbrella guarantee facility of USD 200 M which will support a portfolio of INR 30,000 Crores (approx USD 3.6 B).

The guarantee will be utilised to back capex financing products of organisations engaged in manufacturing, distribution and servicing of EVs, batteries and charging infrastructure.

**Guarantee Type:** Partial Credit Guarantee

**Loan Tenure:** Upto 10 years

**Transaction Type:** Green field Capital Expenditure
THEME FOCUS: BATTERY VALUE CHAIN

Key Takeaways:
- The battery value chain in India has a high-growth potential given the demand for mobility and storage.
- Meeting this demand will require significant investment. The sector can provide attractive returns given the margins and revenue growth potential of the sector.

The battery industry is at the core of a transition from fossil fuels. Global battery demand is expected to surge from 700 GWh in 2022 to 4.7 TWh by 2030, growing at an annualized rate of 27% (McKinsey & Co 2023). This growth is anticipated to be largely driven by the mobility sector. According to the World Economic Forum’s estimates, the battery industry will directly reduce GHG emissions by 30%, add 10 million jobs globally, and add $150 billion of market value to the green value chain by 2030.

FIGURE 16: EXPECTED INCREASE IN GLOBAL LITHIUM-ION CELL DEMAND

Source: Battery 2030, McKinsey & Co (2023)
This rise in demand for batteries globally is mainly driven by regulation and a shift in consumer mindsets. Policies such as the Inflation Reduction Act (USA), FAME (India), and the ‘Fit for 55’ program and 2035 car ban (EU) encourage a green energy transition and the adoption of sustainable mobility, and are expected to be driving forces for battery demand in the future. For example, in countries such as Norway, EV sales have surpassed that of ICE vehicles. However, supply is unable to compete with rising demand. The battery industry is faced with major uncertainty around the supply chain of raw materials. If automakers are to reach their EV targets for 2035, the supply of battery materials needs to increase significantly.

Supply constraints have led to an increase in battery prices globally, despite a drastic decline in raw materials over the last decade. Nonetheless, the price of battery packs is expected to reduce by a third by 2026, once supply has been streamlined, which will allow OEMs to produce mass-market EVs without subsidies and other incentives.
The cost per kWh of a battery pack is lowest in China (approximately $127 per kWh), while packs in the US and Europe are priced 24% and 33% higher respectively (BloombergNEF 2022). The Chinese battery value chain is relatively mature and has evolved with secure contracts for essential cell raw material such as lithium, nickel, cobalt, and manganese. Moreover, the country has built extensive capabilities in the refining industry to cater to the local cell production demand.

Segments of the battery value chain are expected to accelerate through 2030 globally. **The sector provides an attractive opportunity for investors given the potential for revenue growth and the attractive margins.**

**FIGURE 19: RETURNS ACROSS THE BATTERY VALUE CHAIN**

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**CELL COMPONENTS**

A rising demand for EVs translates to a rising demand for lithium-ion batteries, as most EVs today make use of this technology. These batteries are the most critical unit of an EV and comprise around half the cost of the vehicle. The price premium of EVs over ICE vehicles is usually attributed to the high cost of this component. The battery itself consists of five components:
Lithium-ion cells can be further classified based on the active material used in the cathode of the cell. The active material defines the energy density and power of the cell. It consists of lithium and a metal. Active materials display different characteristics depending on the type and ratio of metals. Nickel has a high capacity, manganese and cobalt have high safety, and aluminum increases the power of a battery.

There are five large-scale commercialized chemistries – lithium cobalt oxide (LCO), lithium manganese oxide (LMO), lithium iron phosphate (LFP), lithium nickel manganese cobalt (NMC), and lithium nickel cobalt aluminum oxide (NCA). Battery manufacturers are rapidly trying to pursue higher energy density at lower costs. The table below compares the individual chemistries based on their characteristics and specification which eventually defines their use cases for individual applications (Ion Energy 2020):

<table>
<thead>
<tr>
<th>Chemistry</th>
<th>Chemical</th>
<th>Specific Energy (Wh/ Kg)</th>
<th>Cycle life</th>
<th>Thermal Runaway (°C)</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCO</td>
<td>Lithium Cobalt Oxide</td>
<td>150-200</td>
<td>500-1000</td>
<td>150</td>
<td>Laptops, Phones, Tablets, Cameras</td>
</tr>
<tr>
<td>LMO</td>
<td>Lithium Manganese Oxide</td>
<td>100-150</td>
<td>300-700</td>
<td>250</td>
<td>Electric Powertrains, Power Tools, Medical Devices</td>
</tr>
<tr>
<td>LFP</td>
<td>Lithium Iron Phosphate</td>
<td>90-120</td>
<td>2000+</td>
<td>270</td>
<td>EVs, High-capacity stationary applications</td>
</tr>
<tr>
<td>NMC</td>
<td>Lithium Nickel Manganese Cobalt</td>
<td>150-220</td>
<td>1000+</td>
<td>210</td>
<td>E-Bikes, EVs, Medical Devices, Industrial use</td>
</tr>
<tr>
<td>NCA</td>
<td>Lithium Nickel Cobalt Aluminum</td>
<td>200-260</td>
<td>500-1000</td>
<td>150</td>
<td>Electric Powertrain, Medical, Industrial</td>
</tr>
</tbody>
</table>

Source: Ion Energy 2020
The production of lithium-ion cells is an extremely raw material-intensive process. Estimates suggest that EVs use 6 times more minerals than traditional ICE vehicles. The raw material for these batteries is highly concentrated in a handful of countries. The Democratic Republic of Congo has over 69% of the world’s cobalt reserves. Rising demand led to a 300% increase in cobalt prices between 2016 and 2018. Lithium supply is mostly concentrated in three countries - Australia, Chile, and Argentina. Nickel supply is relatively fragmented, with reserves in Brazil, Russia, South Africa, and Canada. However, the quality of nickel that is suitable for batteries has limited availability.
To ensure continuity of supply of raw material, it is essential to build a robust supply chain. This is often done through long-term partnerships with active material producers and miners. Many players in the battery sector are looking at backward integration or owning the complete value chain—from mining to recycling, to further reduce the volatility of the supply chain. Some cell manufacturers have also signed off-take agreements with key raw materials suppliers, similar to what OEMs are doing with the cell manufacturers.

**INDIAN SUPPLY CHAIN OVERVIEW**

Indian demand for battery storage is expected to touch 160 GWh in the next 5 years (Energy Storage Association in India 2022). India is now joining the global race to scale battery production. Much like the rest of the world, the Indian battery ecosystem is flooded with battery pack manufacturers. As per a leading battery recycling player, India currently has over 280 battery pack manufacturers; however, almost all of them import their cells. This is because there is negligible cell manufacturing capacity in India. Further, other components such as cathodes and separators are also mostly import driven.

The Government of India has taken active strides to reduce this dependence by introducing policies to facilitate localization. Through a PLI scheme, the Government of India is facilitating a capacity of 50 GWh which was oversubscribed by two times. As key criteria of the PLI scheme, bid winners are expected to reach a domestic value addition of 60% in 5 years, which implies establishing a local supply chain for all the key components such as cathodes, anodes, electrolytes, and separators in India.

**TABLE 6: AVAILABILITY OF METALS REQUIRED FOR BATTERY MANUFACTURING IN INDIA**

<table>
<thead>
<tr>
<th></th>
<th>Nickel</th>
<th>Manganese</th>
<th>Cobalt</th>
<th>Copper</th>
<th>Aluminum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>1.3</td>
<td>151.8</td>
<td>0.052</td>
<td>12.16</td>
<td>824.28</td>
</tr>
<tr>
<td>reserves</td>
<td>(million tons)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual</td>
<td>Nil</td>
<td>0.79</td>
<td>Nil</td>
<td>0.787</td>
<td>2.9</td>
</tr>
<tr>
<td>production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(million tons)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average cost</td>
<td>15,790</td>
<td>2,471</td>
<td>38,411</td>
<td>6,775</td>
<td>1,896</td>
</tr>
<tr>
<td>($/ton)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery</td>
<td>Cathode</td>
<td>Cathode</td>
<td>Cathode</td>
<td>Anode</td>
<td>Cathode</td>
</tr>
<tr>
<td>component</td>
<td></td>
<td></td>
<td></td>
<td>current</td>
<td>current</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>collector</td>
<td>collector, cell casing</td>
</tr>
</tbody>
</table>

Source: India Mineral Handbook 2017 & WRI

According to a leading battery recycling company, the Government of India is looking to counteract this raw material dependence by positioning itself as a leader in the battery recycling sphere. The recycling of batteries, or urban mining, may prove to be a very attractive proposition for India as the process allows for the extraction of metals at high purity levels at relatively low capex (in comparison to mining).

The Indian battery value chain provides investors with many attractive opportunities. Enterprises that aim to encourage the circularity in the sector, enhance life span or promote localization could have a catalytic impact on the sector:
In addition to cell component manufacturing, there is a compelling case for businesses in the following sectors:

**Telematics**

Battery Management Software (BMS) and other telematics providers play an important role in decreasing the TCO of EVs, as they help increase the expected life of these batteries. According to industry stakeholders, there is a large market potential for local BMS players as only 5% of pack manufacturers have localized the sourcing of their BMS.

**Recycling**

Battery recyclers are positioning themselves as Urban Mining hubs. Leaders in the sector can make margins due to the high purity of extracted materials. Recyclers are also working to repurpose batteries, creating a secondary market for these components. This sector will become increasingly important as the country looks to localize cell production.

**Innovative Chemistry**

The availability of resources such as lithium and cobalt remain a roadblock to competitive pricing of batteries. Companies are innovating to pursue high performance chemistries at low costs with materials that are more accessible. Thus, innovators developing alternative chemistries which utilize affordable and readily available minerals show promise.

Increased investment into the battery value chain would have a catalytic effect by bringing down battery costs, the most expensive component of EVs. In addition to this, investment into the sector would support the development of a domestic supply chain for raw material and provide more data on the useful life of EVs. A lower upfront cost and greater certainty around EV technology and useful life would address the key roadblock of accessing both investment and affordable financing, unlocking the growth potential of the electric mobility sector in India.
CONCLUSION

The EV market in India is still at an early stage, and every segment of the EV value chain holds immense potential for investors. As demand for EVs increase, there will be a significant increase in the investment requirement across the value chain. Given the capital-intensive nature of vehicle manufacturing, OEMs will require a large quantum of financing. The capital requirement for E2W and E3W manufacturers will be driven by volumes, while E4W and e-bus manufacturing will be driven by cost. Many large OEMs have established separate EV subsidiaries and are raising finance at the subsidiary’s corporate level. This enables them to expand their investor pool to include climate-oriented investors. The E2W and E3W segments are dominated by start-ups and are likely looking at receiving direct investments to expand their operations.

To increase EV adoption, there needs to be sufficient charging infrastructure in place, and the upfront price of EVs will need to reduce. Many consumers are still hesitant to purchase EVs due to range anxiety. Significant investment will be required to build out charging infrastructure, including battery swapping networks, to cater to India’s rising EV demand. Investment into R&D and localization of battery manufacturing will be pivotal as the battery is the most expensive component of an EV. The government has implemented incentives such as PLI schemes and reduced customs duties to increase India’s domestic battery manufacturing capabilities. Investment into this sector appears to be an attractive opportunity for investors to catalyze the EV sector and also support a stronger local battery supply chain, which will ultimately reduce India’s fuel import bill significantly. The manufacturing of other EV components is also being incentivized to increase the localization, and consequently decrease the upfront cost of the vehicles.

It will be critical for investors to identify which sub-segments are best suited to their return expectations, timelines, and investment theses, and choose companies that stand out in terms of their value proposition and traction for good exit opportunities. Despite challenges such as limited access to capital, high upfront costs, and inadequate infrastructure, the sector is set to see accelerated growth over the next few years. This growth is driven by tailwinds including an increased interest in climate change mitigation, pollution and carbon emission reduction, and energy security. India’s supportive policy is aimed at encouraging local production of EVs and EV components, which will bring down costs and will consequently encourage EV adoption. The large market size for EVs, as well as its position as a market leader in the overall automobile sector, makes India well positioned to become a global leader and hub for EV investment.
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