



Carpe diem!

Electric vehicle charging – the next big opportunity



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Executive summary

Driven by environmental concerns and commitment to a greener planet and catalysed by rising fuel prices, electric car sales increased by 116 per cent from 2020 to reach 6.6 million¹ in 2021. With this, the total number of electric vehicles (EVs) on the roads rose to 16.5 million in 2021. As the fledgling EV ecosystem matures at a rapid pace, a critical facilitator of EV adoption is ready availability of slow and fast chargers ensuring easy access to efficient and cost-effective charging.

Development of a robust charging network has gone hand-in-hand with accelerated EV adoption across the world, and we believe a similar trend is expected to play out in India. India's EV trajectory is rising rapidly, with a threefold increase in EV sales in the last fiscal². While the EV growth story is currently led by two wheelers (2W) and three wheelers (3W) segments, four-wheeler (4W) segment is showing enormous promise, with several new model launches expected over the next two years.

The pace of charging infrastructure development in India is gaining momentum, driven by policy reforms and continuous expansion by public and private players. With an estimated 45-50 million³ EVs on Indian roads by 2030, the potential opportunity for a pure play charging business is enormous.

Not surprisingly, investment activity in charging businesses across the world has surged, with a number of pure-play charging companies raising funds through initial public offerings (IPOs), strategic investors and venture capitalists at massive valuations.

India's charging infrastructure demands are unique, considering that the vehicle mix is dominated by 2Ws and 3Ws, as opposed to 4Ws across the rest of the world. Further many EV users have limited access to private charging, and a robust public charging infrastructure would be critical to enable widespread EV adoption across India.

2Ws and 3Ws are best suited for alternating current (AC) slow charging. Their batteries are not designed

to handle fast charging and battery swapping is likely to be the prevalent mode for use cases requiring quick charging turnaround.

4Ws come in a variety of battery sizes and utilise a range of charging standards. Depending on the use case and battery size, both AC and direct current (DC) charging solutions are suitable.

Buses are likely to be charged exclusively through DC fast chargers, due to their large battery sizes and high-power requirements.

When it comes to charging location preferences in the Indian market,

Home and workplace charging is likely to be the dominant model for private 2W and 4W vehicles, AC slow chargers are likely to be used as they would be cost-effective.

Commercial fleet (3W, 4W and light commercial vehicles (LCV)) is likely to be charged at private depots or public charging network, mainly using AC chargers for overnight charging. DC charging is likely to be restricted for top-up charging during the day, subject to economics working out.

As the 4W EV stock increases, demand for public charging solutions – DC fast chargers for highway charging and moderate/fast AC chargers for destination charging – is likely to ramp up. Public charging companies across the globe are witnessing improved utilisation and profitability driven by increasing EV stock and customers' preference for fast, public charging.

While the technical specifications are likely to vary for different customer segments, service level expectations of accessibility to charge point locations, ease of charging, affordability, integration with multiple payment modes and network reliability will be common and are expected to play a critical role in influencing customers' choice of charging point operator (CPO) and solution.³

1. Global electric car sales have continued their strong growth in 2022 after breaking records last year, International Energy Agency (IEA), 23 May 2022

2. Sale of EVs Triple in India in 2021, Electric Mobility Picks up Momentum, Hindustan Times, 8 March 2022, accessed on 7 June 2022

3. KPMG analysis



For a charger manufacturer, ensuring charger quality at a competitive cost is key to survival in the value-conscious Indian market. In order to differentiate themselves in a likely commoditised business, original equipment manufacturers (OEMs) would need to provide customised products, invest in innovative designs or broaden their scope to offer value-added services like integrated software for remote monitoring, predictive maintenance, etc.

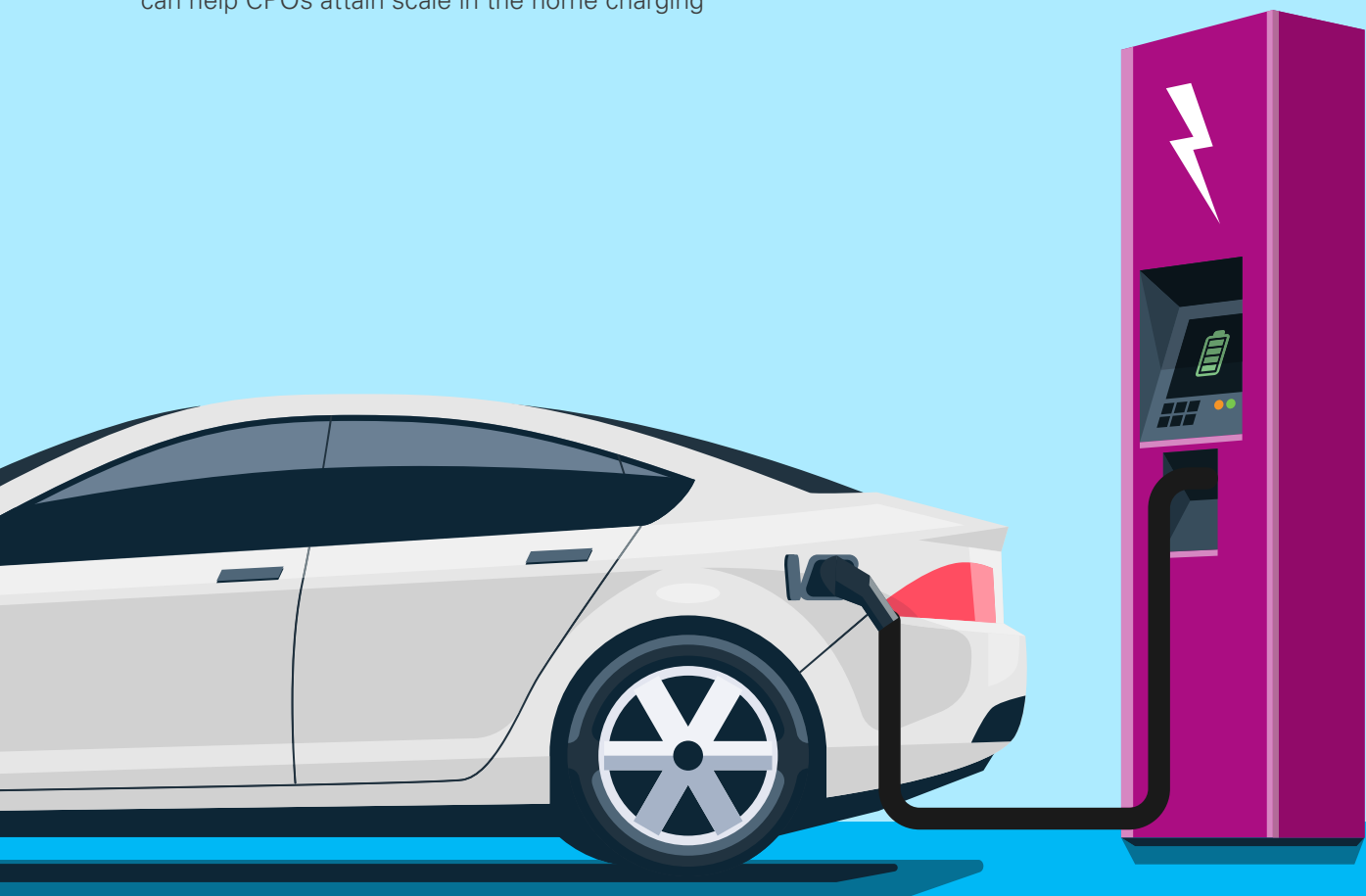
From a CPO perspective, having a dense network of charging points located in high-traffic strategic locations is the most important factor. Co-location or revenue sharing agreements with retail chains, malls, restaurants, etc. would help in gaining access to these prime locations and managing real estate costs. In addition, interoperability of the charging network and offering value-added services like payment, navigation, and booking, among others is important for overall customer experience and stickiness.

Depending on the chosen segment, the right set of strategic partnerships and alliances can serve as a significant source for creating and sustaining a competitive advantage in the CPO business. For instance, partnering with select housing societies can help CPOs attain scale in the home charging

market. Similarly, becoming a preferred charging network provider for an EV OEM or rideshare fleet provider would ensure utilisation and customer loyalty to some extent for a CPO engaged in the public charging segment. Partnering with municipal bodies to set up 3W charging points in public parking lots, metro stations etc. would help a CPO to capture the vast potential of the fastest growing EV segment today.

To conclude, the Indian EV charging market shows immense potential on the back of rising EV demand across all vehicle segments. Companies can choose to specialise in single or multiple charging solutions depending on their business objectives, internal capabilities and long-term vision.

There are likely to be a few challenges in the near term related to utilisation and in some cases even viability of the business. However, over the medium to long-term, product and service-led innovation allowing the players to differentiate themselves from competition would be key to having a head-start in a part of the EV ecosystem that is critical to drive the growth of e-mobility in India.





01

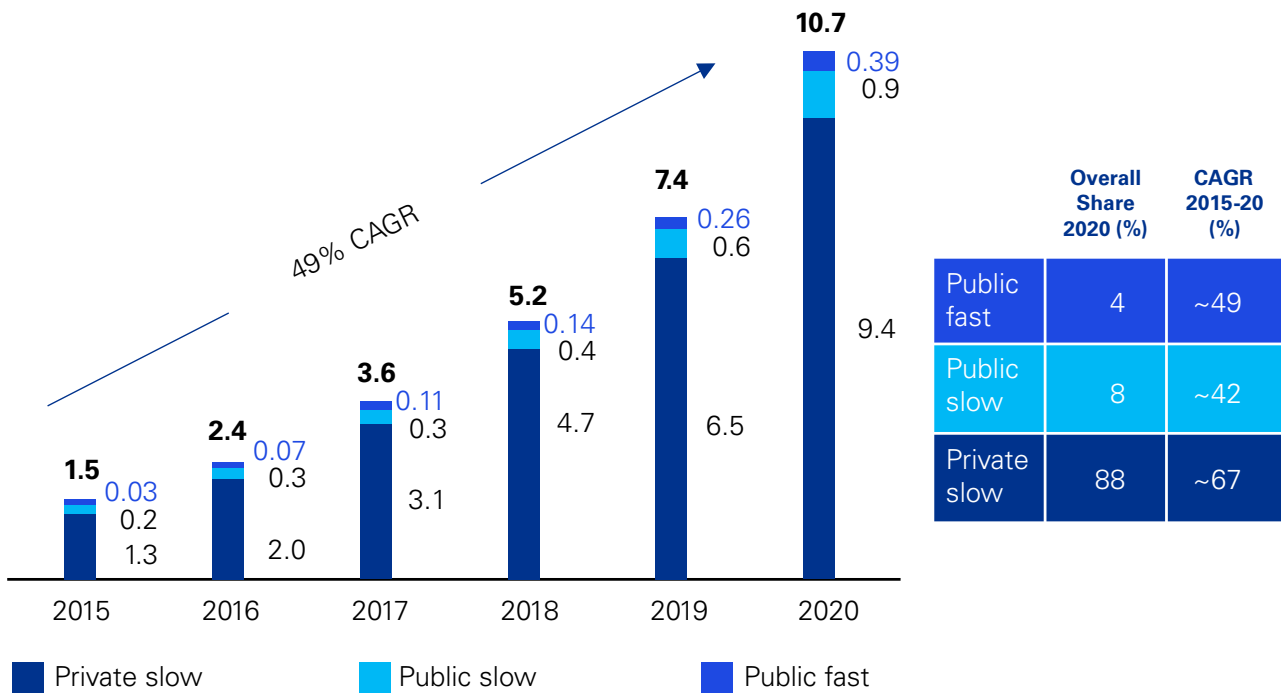
Electric vehicle (EV) charging: a massive opportunity

Charging infrastructure, as a critical enabler for EV adoption, creates several market opportunities for players in the rapidly evolving electric mobility landscape.

Favourable market trends and policy support boost the global charging infrastructure market

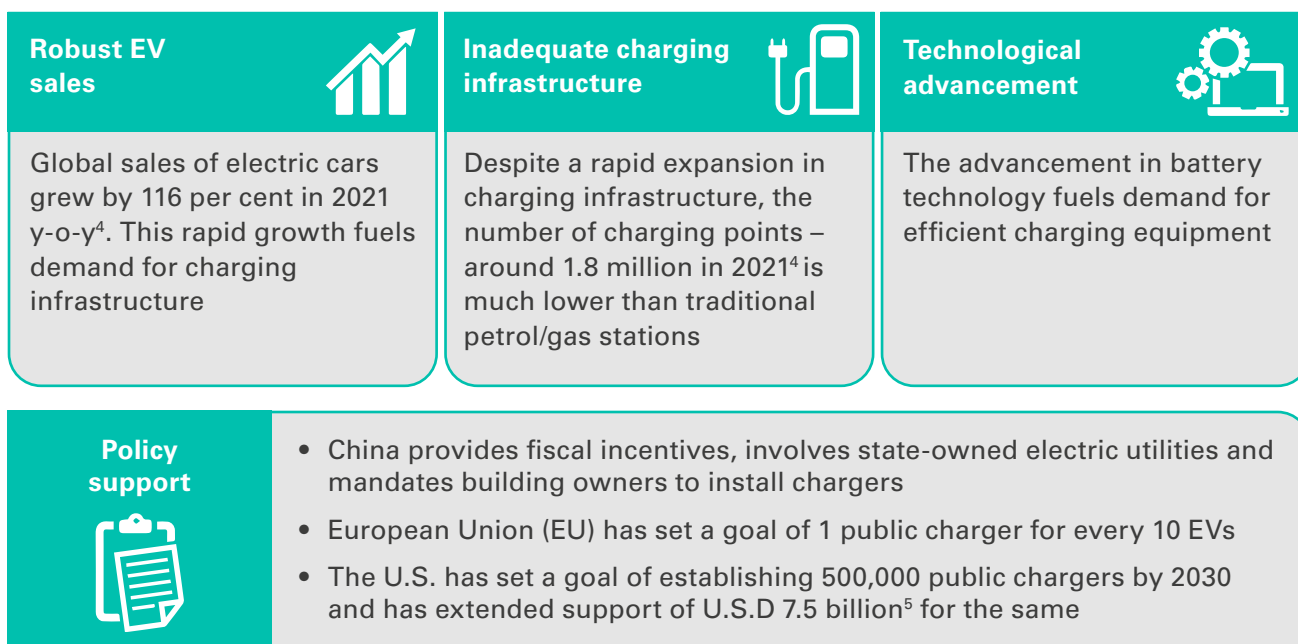
The global charging infrastructure market has witnessed significant growth over the last few years (Figure 1). While residential and workplace charging remain the dominant modes of charging, public charging infrastructure has expanded manifold to alleviate the ‘range anxiety’ concern of customers, which is likely to help facilitate EV deployment goals rapidly.

Figure 1: Electric Vehicle Supply Equipment (EVSE) stock (2015-2020) (in million units)⁴



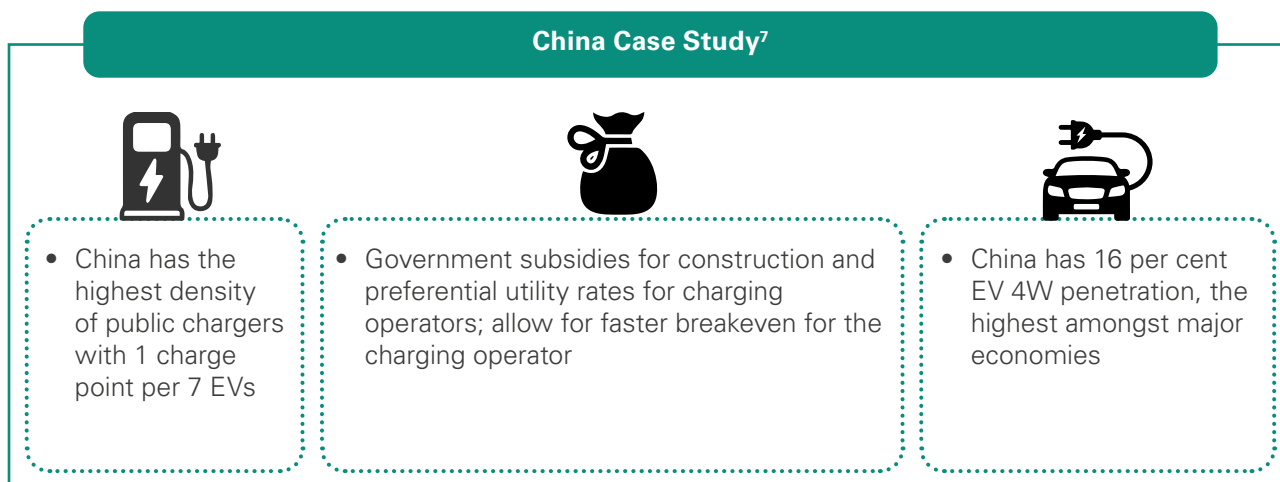
4. Trends and developments in electric vehicle markets, International Energy Agency

Figure 2: Key factors driving growth



Countries with better charging infrastructure have seen accelerated adoption of electric vehicles

An analysis by World Bank indicates that investing in charging infrastructure is 4-7 times⁶ more effective in EV adoption than providing EV purchase subsidies. Countries like Norway and China have seen faster EV adoption through their sustained efforts towards expanding the public charging infrastructure. China is currently the global leader in the number of publicly available chargers, accounting for 85 per cent of global fast chargers and 55 per cent⁷ of slow chargers.



5. White House Briefing Room, June 9, 2022

7. Trends in charging infrastructure, IEA

6. If you build it, they will come: Lessons from the first electric vehicles, World Bank, December 2021

Norway Case Study⁸



- Norway started providing 100 per cent subsidy for public charger installation in 2009-10



- By 2015, Norway had 10,000 charging stations
- Currently, Norway comprises only 1 per cent of EU's population; however, has 8 per cent of EU's public charging stations

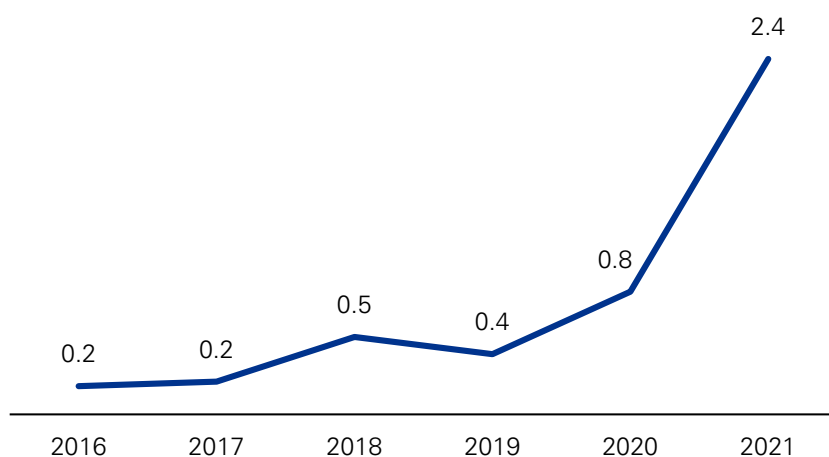


- Public charger availability along with favourable EV policies have led to a penetration level of greater than 70 per cent in Norway

Global investment activity has been on the rise, with expected funding of USD2.3 billion by the end of 2022

Investment activity in this niche segment has surged in the last two–three years, with companies obtaining funding through IPOs, venture capital (VCs) and strategic acquisitions. Based on long-term revenue projections, investors see players in the EV charging market as promising investment prospects.

Figure 3: Global funding activity in EV charging infrastructure market (in USD billion)⁹



Key drivers of M&A activity

Charging infrastructure, being a young and fragmented segment, opens M&A opportunities on various fronts

Big utility and oil companies acquiring charging operators fuels a consolidation wave

EV charging companies are going public through mergers with special purpose acquisition companies (SPACs)

8. Charging infrastructure experiences in Norway – the worlds most advanced EV market, October 9-11 2017 Tracxn database, accessed on 27 June 2022

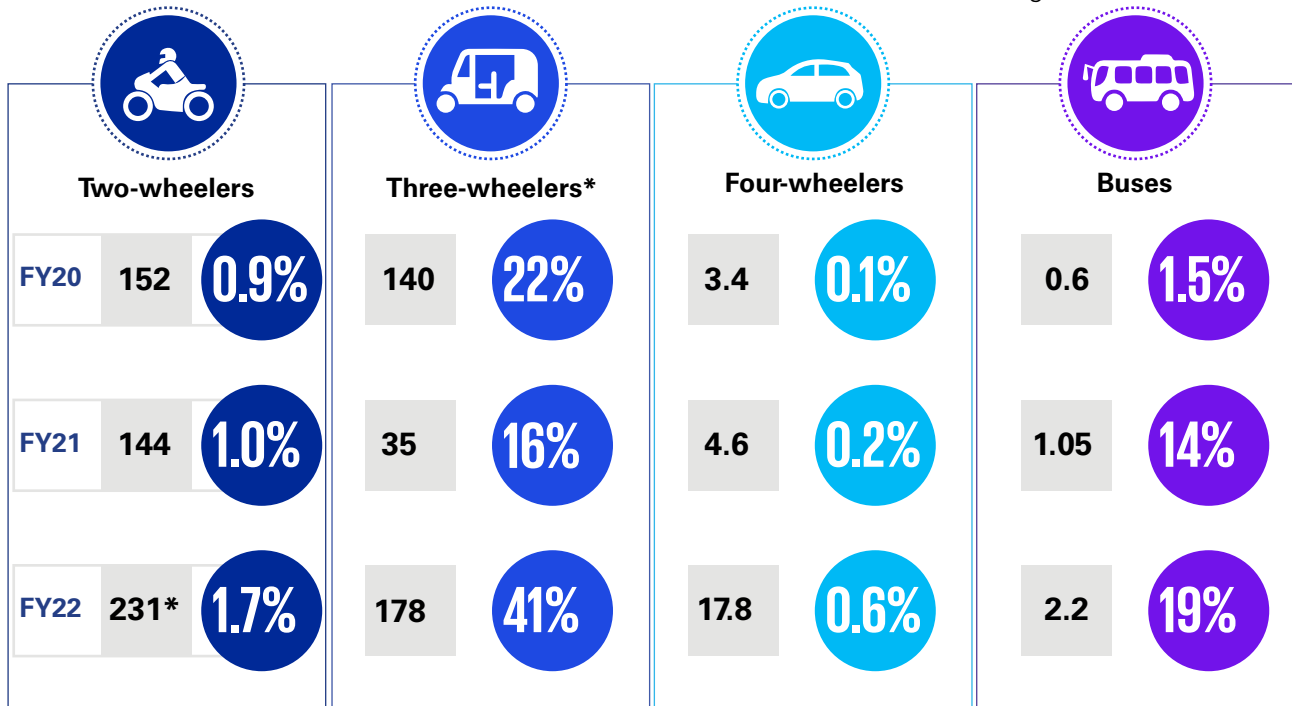
9. Tracxn database, accessed on 27 June 2022

India's e-mobility journey is on a fast track, with an estimated 45-50 million EVs on road by 2030

India's electric mobility story is rapidly evolving, with EVs gradually entering the mainstream, resulting in a threefold rise in EV sales over the last fiscal year. The growth is currently being led by two-wheeler (2W), three-wheeler (3W), and bus segments. While EV penetration in India is currently low (about 1 per cent¹⁰), a large increase in EV sales is anticipated due to favourable factors on the demand, supply and regulatory front.

Figure 4: EV historical sales and penetration (as a percentage of total vehicle sales)¹¹

All figures are in '000 units



*EV 2W numbers for FY22 include high speed models only

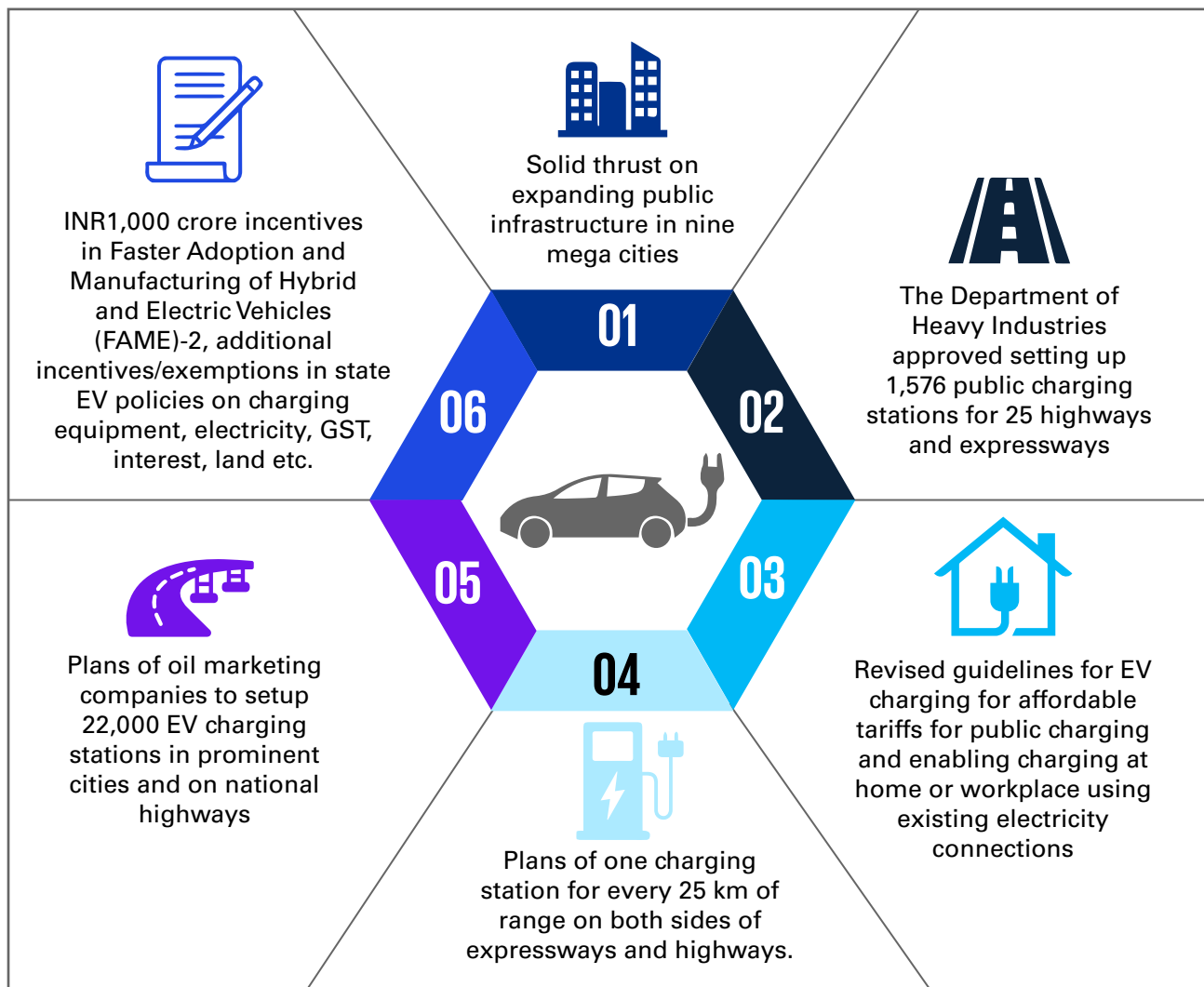


10. Sale of EVs Triple in India in 2021, Electric Mobility Picks up Momentum, Hindustan Times, 8 March 2022, accessed on 7 June 2022

11. SMEV Data, SIAM, Department of Heavy Industries, FADA

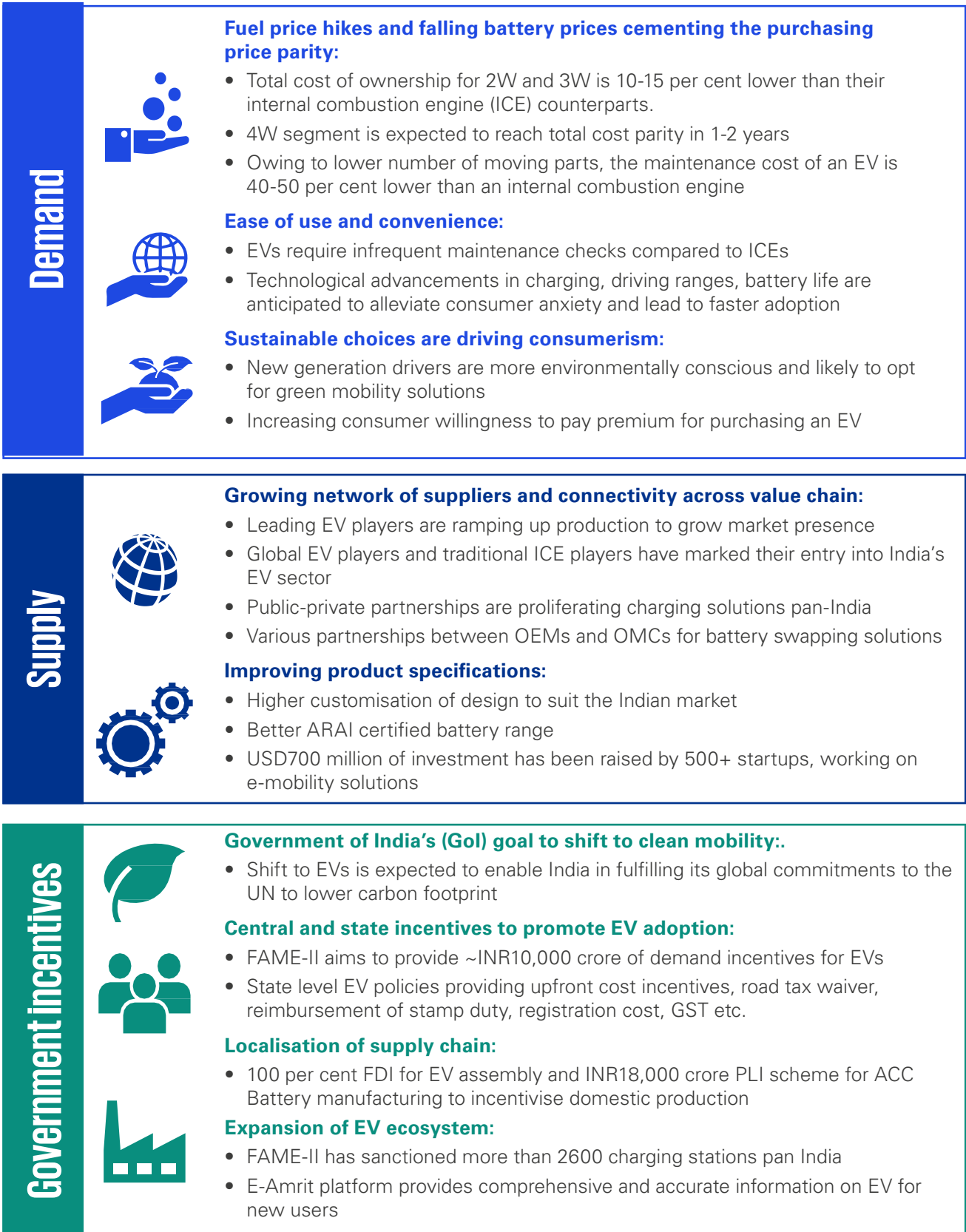
As of March 2022, the number of EVs on Indian roads had surpassed one million. This number is likely to grow to 45-50 million EVs on road by 2030. This presents an enormous opportunity for players in the EV charging ecosystem. Currently, only about 1,700 public charging stations are operational across the country¹² which is inadequate to support the EV growth. Nevertheless, there has been a strong government push to improve penetration of charging network and increasing interest from public and private players, which is likely to bring in the much-required investments in this space.

Figure 5: Strong regulatory push for expansion of charging infrastructure¹²



12. KPMG analysis derived from secondary research

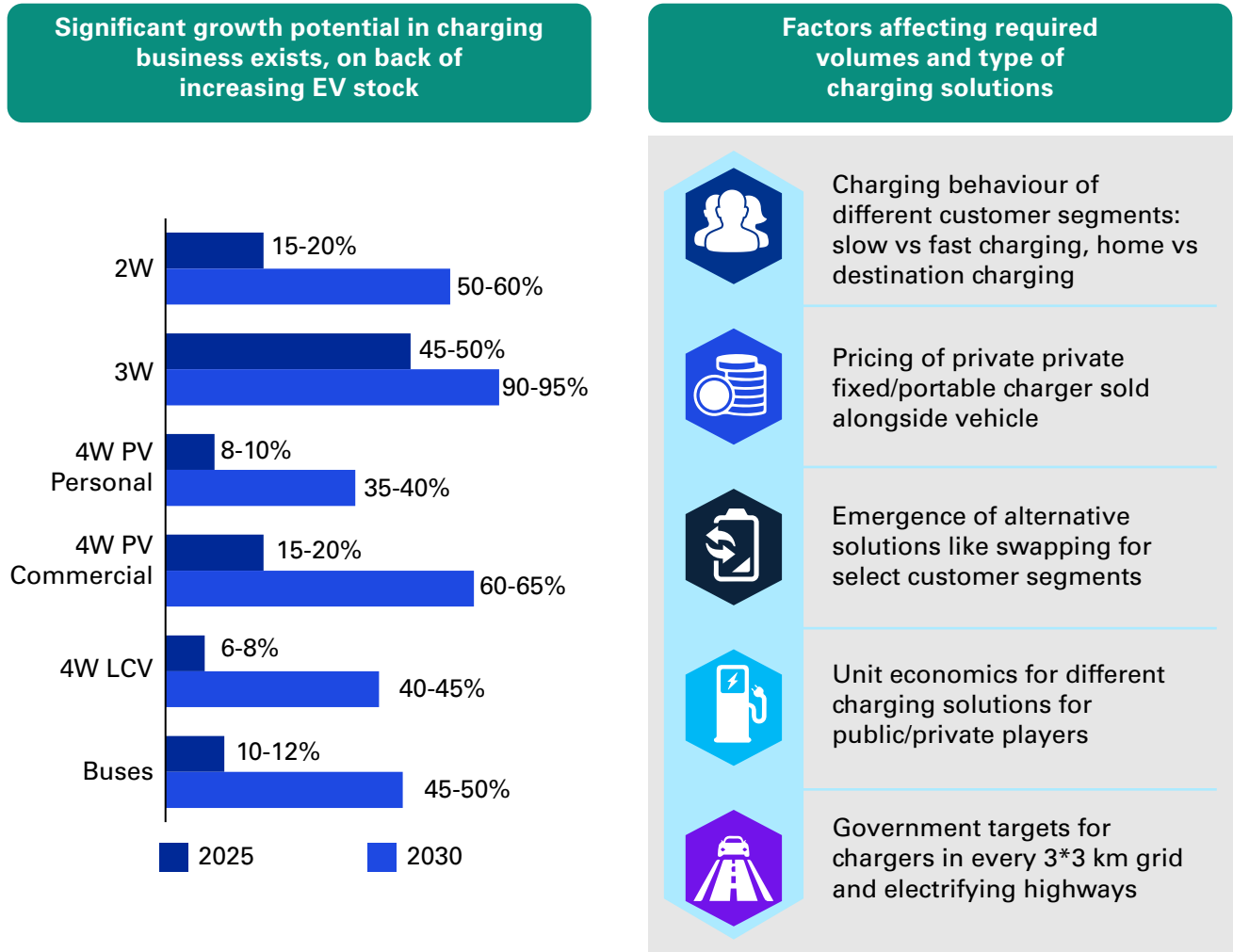
Figure 6: A mix of enabling factors on demand, supply and regulatory front likely to fast-track India's EV journey¹³



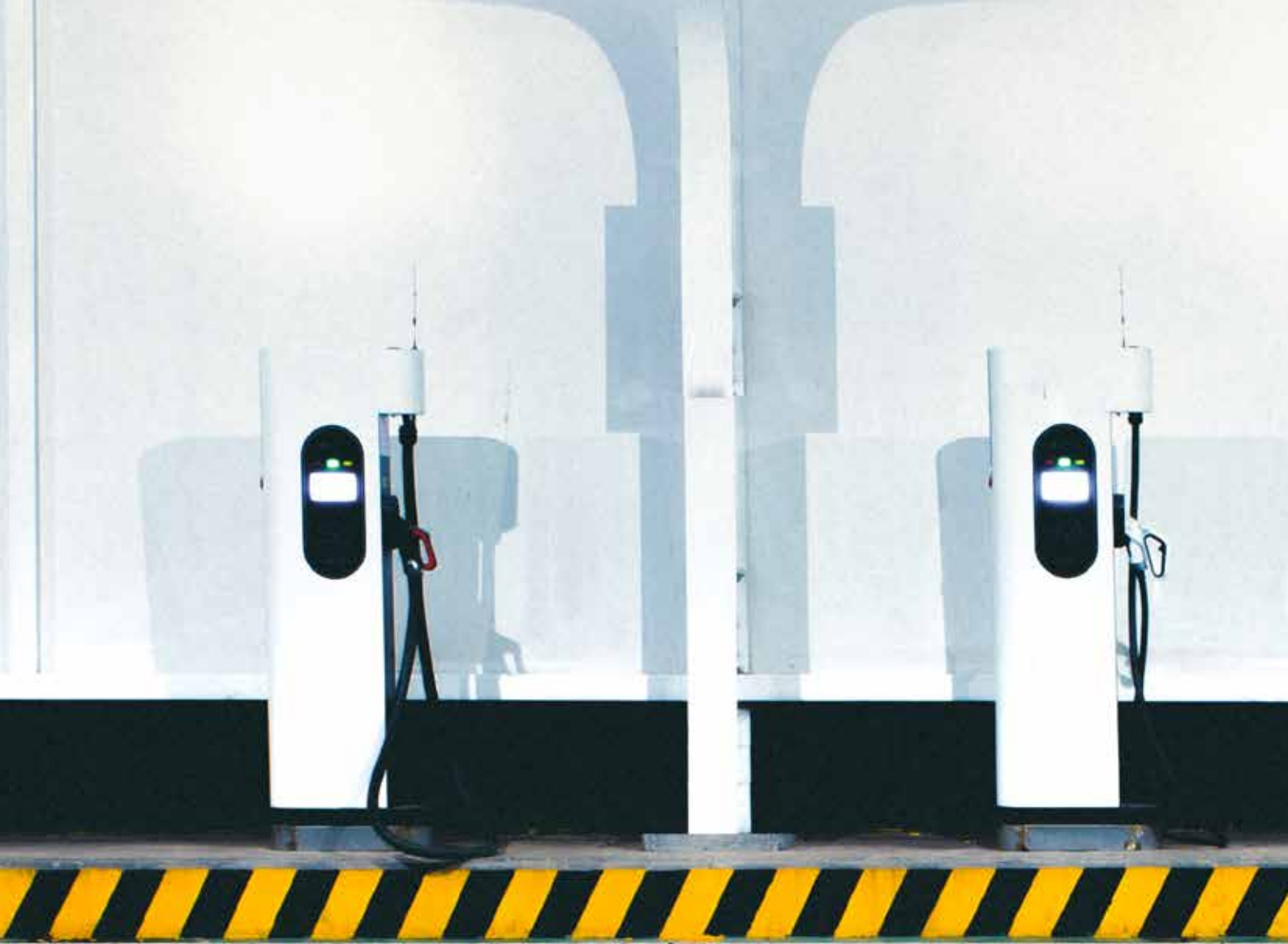
13. KPMG analysis derived from secondary research

Huge charging potential exists on the back of rising EV demand across segments

Figure 7: Charging infrastructure market is slated for exponential growth, a mix of factors is expected to determine the volumes and type of charging solutions required¹⁴



14. KPMG analysis



02

Bespoke and tailored charging solutions for various EV segments

Different charging technologies for various vehicle segments

A range of charging methods and technologies have emerged globally depending on the OEM designs and technical standards adopted in each country. Broadly, chargers can be segmented based on the current type and power rating.

Table 1: Charging power and energy requirements of different EV segments¹⁵

Charging methods	Power level	Current type	Compatible EV segments
Normal charging	$P \leq 7 \text{ kW}$	Alternating current (AC) and direct current (DC)	2Ws, 3Ws, cars and other Light Commercial Vehicles (LCVs) (up to 1 tonne)
	$7\text{kW} < P \leq 22 \text{ kW}$	AC and DC	
High power charging	$22\text{kW} < P \leq 50 \text{ kW}$	DC	Cars, LCVs and Medium commercial vehicle (MCVs) (1–6 tonnes)
	$50\text{kW} < P < 200 \text{ kW}$	DC	

Note: AC charging: AC power is delivered to the onboard charger of EV, which converts it to DC. DC charging: The charger converts AC power from the grid to DC before it enters the vehicle, bypassing the onboard charger.

Table 2: Charging power and energy requirements of different segments¹⁶

EV segment	Battery size	Slow charging	Fast charging
2W	1–3 kWh	0.5–1 kW	NA (Swapping more prevalent model)
3W	3–10 kWh	0.5–1 kW	2–3 kW
Car	20–45 kWh	3 – 20 kW	20–100 kW
LCV	20–45 kWh	3 – 20 kW	20–100 kW
Bus	100–400 kWh	7–50 kW	50–500 kW



15. Handbook of Electric Vehicle Charging Infrastructure Implementation

16. Electric vehicle charging infrastructure, Lighthouse discom programme - a NITI aayog, RMI India + Rocky Mountain Institute collaborative, May 2020

India's charging infrastructure demands are unique, considering that the vehicle mix is dominated by 2Ws and 3Ws, as opposed to advanced countries where 4W is the dominant segment. As power requirement varies across EV segments, the same charging method is not suitable for all segments:

- 2Ws and 3Ws have small, low voltage batteries, and normal AC power charging is adequate for these segments
- 4Ws have varied battery sizes and utilise different charging standards. While single-phase AC chargers are suitable for cars with single-phase onboard chargers, three-phase AC chargers are required for cars with larger onboard chargers

- Buses have large battery sizes and high-power requirements, which makes DC fast charging the most suitable for this segment

While all EV owners prefer fast charging, this mode of charging is not suitable for all vehicle segments. Aside from the higher cost associated with fast chargers, it might have an adverse impact on battery life and therefore, not all vehicle models are designed to handle fast charging. Most of the existing e-2W and 3W models in the Indian market are suited for slow charging and battery swapping is emerging as an alternative for use cases where fast charging is required.

2Ws and 3Ws are best suited for AC slow charging. Battery swapping likely to be the more prevalent model for use cases requiring quick charging turnaround



A mix of public and private charging solutions to serve different customer segments and use cases

Charging solutions can be broadly segregated into four groups depending on the charging behaviour and preferences of various customer segments. The most suitable charging technology and configuration is likely to vary depending on the choice of charging solution. Private vehicle owners typically have more charging flexibility than commercial vehicle owners, who are bound by time or fixed routes.



Table 3: Home/workplace and fleet charging solutions show maximum potential in the short term; shift to take place to public charging as the market matures

	Home/workplace charging	Fleet charging	Destination charging	On-the-go charging
Locations	Private parking, shared parking in residential complexes and workplaces	Fleet depots	Retail spaces (malls, restaurants, hotels etc.) and parking stands	Highways and high-traffic areas
Primary vehicle segments and use case	Private 2Ws and 4Ws	Commercial fleet, including 3Ws, 4Ws and CVs	All	Private 4Ws
Charging duration	Multiple hours per day (overnight at home or working hours at office)	Depending on fleet management. Objective to reduce idle time during work hours	3–4 hours depending on average stay duration at destination	< 1 hour on-the-go
Parking set-up	Private or shared	Private	Public	Public
Suitable charging technology	Primarily slow charging through AC chargers	Moderate AC (level 2) chargers for 3W and 4W fleet; DC charging for buses	Mix of slow and moderate (levels 1/2) chargers	High power DC fast (level 3) chargers

Demand for public charging to pick up as EV market matures

Indian market is likely to have a dense network of AC private and public chargers; DC chargers to be restricted to buses and few use cases for 4Ws and LCVs



- Majority of charging for private vehicles in India is likely to be done at home or at work using AC slow or medium chargers.
- Commercial fleet users, on the other hand, are likely to rely on fleet charging solutions including a combination of moderate and fast-speed chargers based on the use case, vehicle segment and affordability. For instance,

AC charging at depots is likely to be the predominant mode for overnight charging of 3W, 4W and LCV fleet. For top-up charging during the day, level 2 AC and DC chargers would be most suited. Bus fleet, on the other hand is likely to be exclusively charged through DC chargers (>100 kW).



03

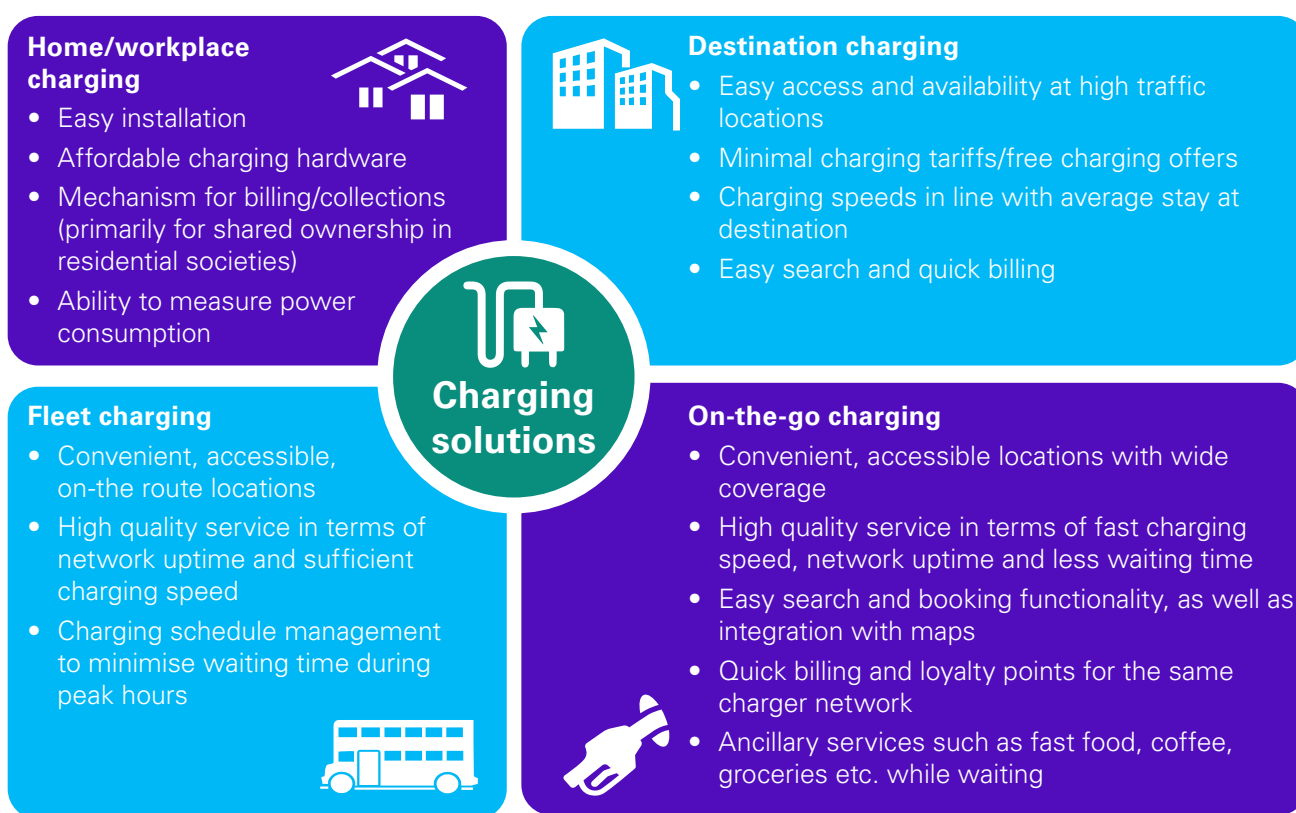
Understanding the spectrum of consumer charging expectations

Understanding of customer needs and expectations is the key for designing an appealing and compelling value proposition

In India, the charging environment is still at a nascent stage. Customers' expectations of varied charging solutions is likely to evolve as new ones emerge. For instance, when it comes to home charging, the primary criteria are affordable hardware and ease of installation, although charging speed is not as crucial as it is for a fleet user. The location of charging stations needs to be accessible and convenient for both destination

and on-the-go charging solutions, along with quick search and reliable network coverage. Customers are likely to pay a higher premium for faster charging with a reduced waiting time for ,on-the-go' charging. However, for destination charging, they will expect appealing pricing offers or even free charging, while spending time at shopping malls, restaurants or supermarkets.

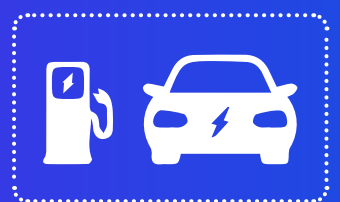
Figure 8: Customer expectations to evolve from different charging solutions



To capitalise on growing opportunities, charging providers need to establish a large network of charging stations through collaborations with retailers, restaurants, etc. Furthermore, EV owners expect to be able to access all charging points in their location, necessitating coordination between providers and competitors operating in the same area. Many global players

have put competitiveness aside and joined forces with competitors to provide a seamless charging experience to customers and address their range anxiety concerns towards EVs. The widespread availability of charging networks, as well as interoperability in EV charging, is likely to be the key in acquiring new customers and retaining them through a subscription model.

Accessibility, convenience and affordability are critical factors influencing customers' choice of charging station. Strategic partnerships for real estate and interoperability are crucial to strengthen customer outreach





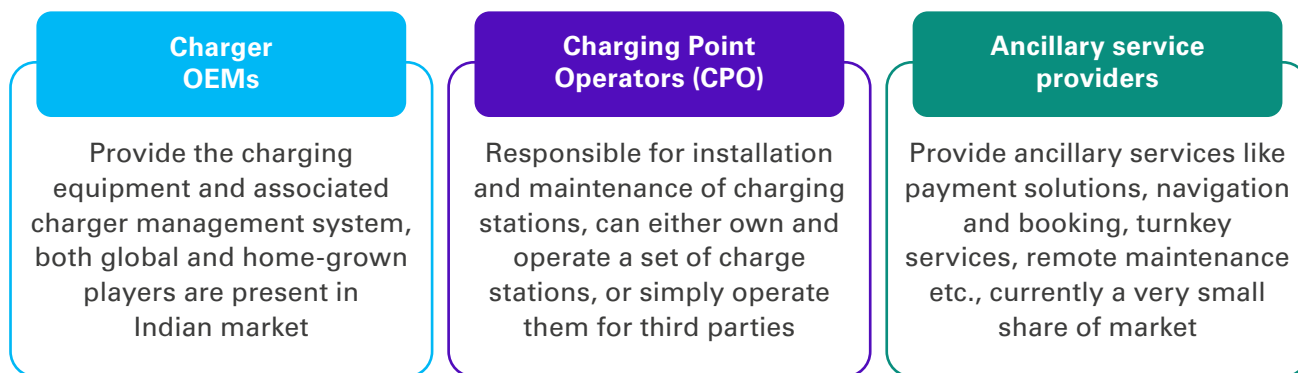
04

Winning the battle in the charging ecosystem

Multiple business models in charging have emerged globally, based on the role of the player along the charging value chain. These players include EV charging-focused pure-play startups that have scaled to large incumbents – oil and gas companies; utilities; auto OEMs; etc. While some players specialise in a single link of the chain, such as charging equipment or e-mobility services, others offer an integrated offering that includes charger supply as well as installation,

commissioning, operation and maintenance of the charging station.

Broadly, three types of players are present in Indian charging ecosystem. The winning strategy for each player would differ, depending on the 'field of play' which is governed by the choice of charging technology (AC/DC), customer segment (Residential/Fleet), vehicle segment (2W/3W/4W), location (public/private) or service proposition.



Product customisation, design innovation and software integration would serve as key differentiating factors for charger manufacturers

Charger manufacturing currently captures the largest pie of charging opportunity. The market is poised for strong growth on the back of increased demand from CPOs and residential/commercial customers alike. Ensuring product and service quality at a competitive cost is very critical in the value-conscious Indian

market. To differentiate themselves in an otherwise commoditised business, players would require to specialise in customised products, designs or broadening their scope to provide value-added services like software for predictive maintenance.

Key success factors in charging OEM business








Right selection of location, technology, power infra, value-added services and ensuring network reliability are crucial for CPO's successful operations

The CPO segment in India is still in its infancy, and companies are experimenting with various approaches and models, in order to address the diverse demands of various vehicle and consumer

segments. While specifics vary, right selection of the following operating model elements is essential for success in this space.

Key elements of operating model for CPO business

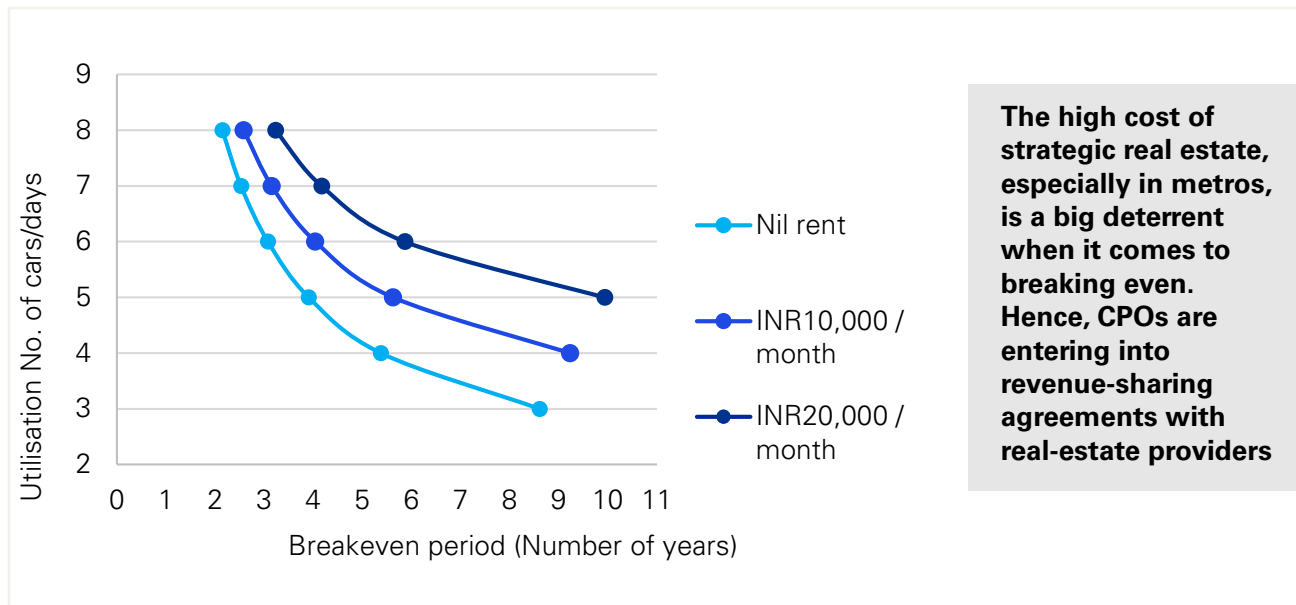
<p>Location</p> <ul style="list-style-type: none"> Strategic, high demand location with good accessibility – the most critical factor Assessment of traffic volumes, EV penetration, parking availability, points of interest required. 	<p>Network reliability</p> <ul style="list-style-type: none"> Ensuring network uptime and service quality and reliability are critical to develop customer loyalty and stickiness. 	<p>Value-added services</p> <ul style="list-style-type: none"> Ancillary services like payment solutions, navigation and booking, branding etc. can help not only to improve revenue and margins, but also improve overall customer experience and stickiness. 
<p>Power infrastructure</p> <ul style="list-style-type: none"> Need for network extension or system augmentation, can be an expensive and time-consuming affair Technical pre-feasibility check and estimated cost and time involved required. 	<p>Charging technology</p> <ul style="list-style-type: none"> Interoperability with different EV models and battery types; ensuring safety is paramount Assessment of charging behaviour of target customer segments, a pre-requisite for charger selection. 	

At current utilisation levels, CPOs are unable to recover their costs and generate meaningful returns. The issue is more pronounced in case of DC chargers due to significantly higher costs associated with charging equipment and power infrastructure. To illustrate, a single DC 60 kW charger takes a

minimum of eight years to achieve breakeven at current utilisation levels of three to four cars per day, if we assume nil land rent. However, as utilisation improves, the initial investment can be recovered at a much quicker pace.



Managing real estate cost coupled with increasing utilisation levels are key to a profitable CPO business¹⁷



Strategic partnerships and alliances are paramount to seize the opportunity in the burgeoning CPO segment

Strategic partnerships and alliances would be crucial for players to develop and sustain their competitive advantage in the CPO market. CPOs across the globe have used this strategy to fulfil one or more of their business objectives, including driving utilisation, ensuring customer stickiness, enhancing customer

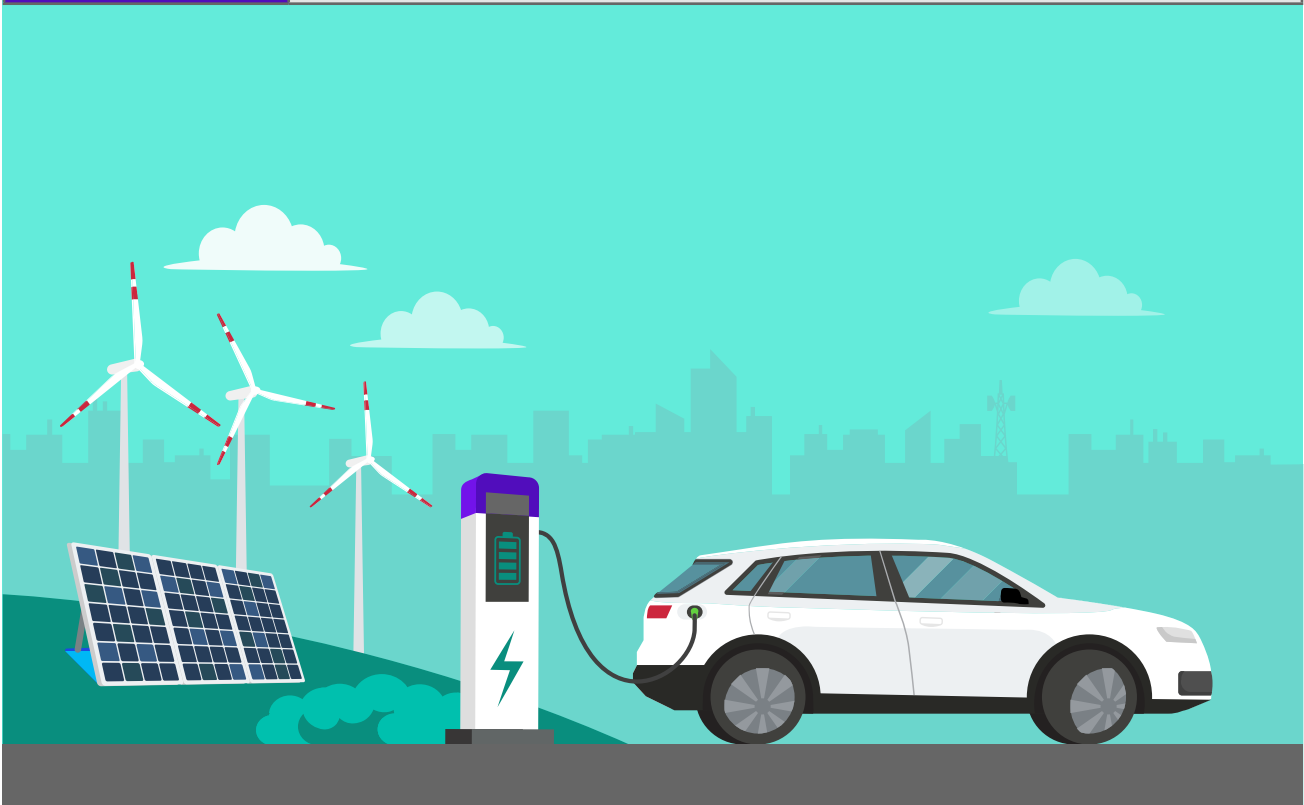
experience, and achieving scale. We expect similar trend playing out in the Indian market with CPOs collaborating with a range of partners including EV OEMs, retailers, automotive dealers, corporates, housing societies etc. to win in this market.

17. KPMG analysis based on industry interactions

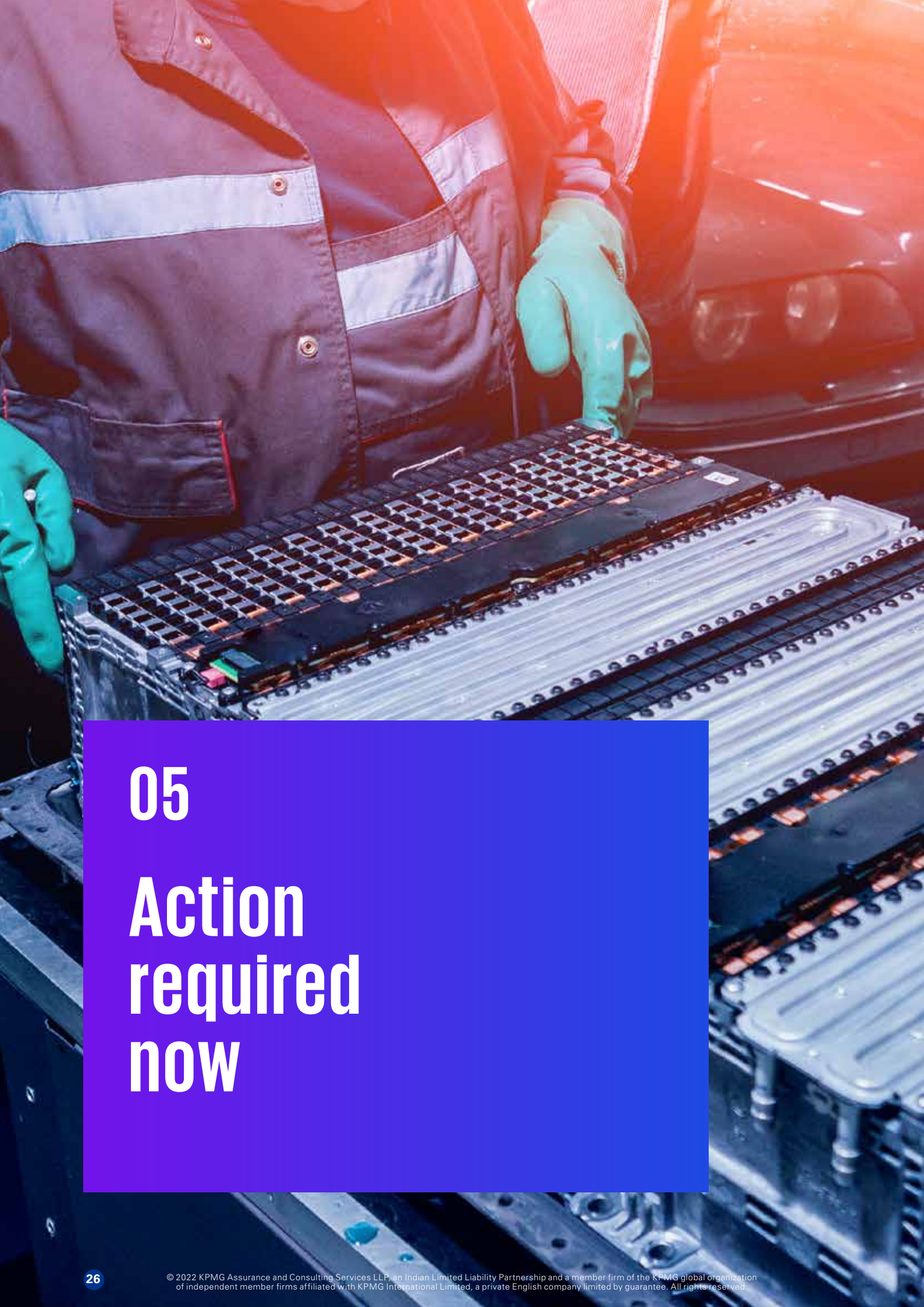


Table 4: Key strategic partnerships for CPOs

EV OEMs	Preferred charging network provider for partner EV OEMs; offer attractive subscription plans
Auto dealerships	Strengthen customer outreach at point-of-sale through local dealer network (OEM alliance or standalone basis)
Housing societies	Collaboration with housing societies to provide home charging solutions (mainly AC slow chargers for 2Ws and 4Ws)
Retailers	Co-location/revenue-sharing models with retail partners for access to premium sites in high traffic areas
Fleet partners	Preferred charging network provider for drivers engaged with rideshare, food/grocery delivery fleet
Municipal bodies	Install public charging points in places of interest including metro stations, parking stands, kirana stores, etc. (mainly AC slow chargers for 3Ws and 4Ws)
Service providers	Partnerships with service providers for navigation, payment solutions and reservation for enhanced and seamless customer experience
Other charging networks	Allow customers to use platforms interchangeably, supporting interoperability and open-source charging protocol





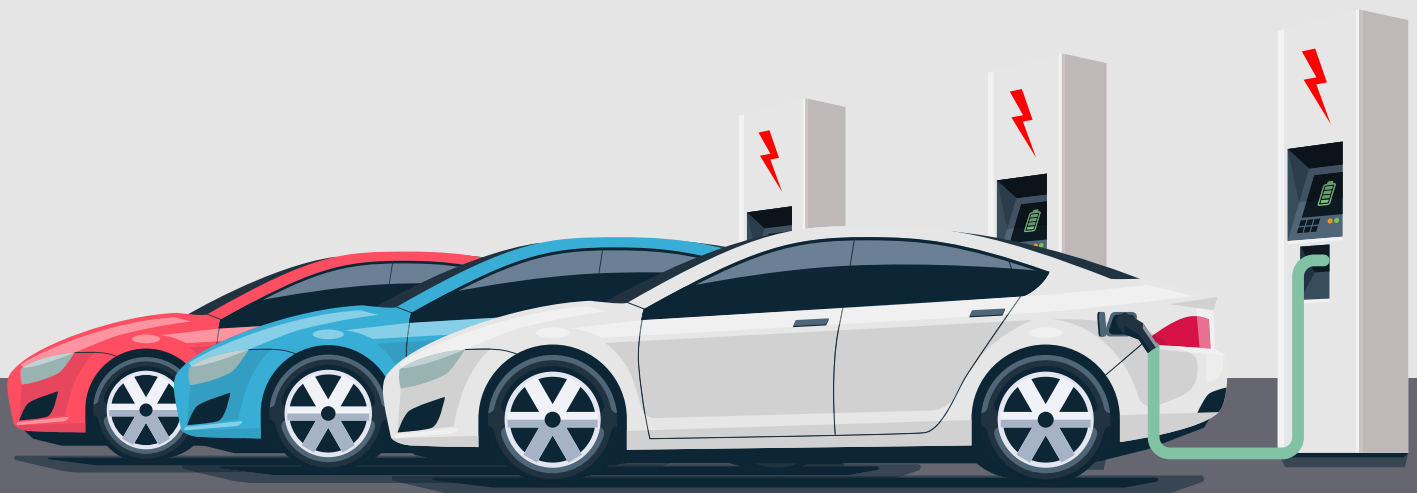


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Action required now

EV charging is emerging as the next big opportunity in the fast-evolving Indian EV ecosystem. A number of public and private enterprises from different spheres have already made in-roads in this interesting space, which include charger OEMs, pure-play charge point operators, oil marketing companies, utilities and EV fleet operators. The competition in this space is likely to intensify as EV sales go up and the market matures. It is, therefore, important that companies looking for success in this business carefully choose their 'field of play' and develop winning strategies to gain a competitive edge over their competitors through innovative products, top-notch service, strong network, and multiple strategic partnerships.

Collaboration, investment and innovation is key to drive success.



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