Building India's future: Opportunities in green mobility and logistics

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EY Parthenon

Building a better working world

Foreword

India is making strides towards achieving its GDP target of US$26 trillion by 2048. Last year, we had asserted that India's transportation and logistics sector would see investments to the tune of US$146 billion over the next few years.

The government's initiatives of Gati Shakti, Maritime Vision, National Logistics Policy, National Rail Vision, UDAN Scheme and Bharatmala Pariyojana, are resulting in an improvement in efficiencies and streamlining logistics in the country. Private participation is also strong in these sectors, which is sure to contribute towards the country's growth goals.

The focus should now shift to sustainable mobility and logistics to decrease emissions and address the increasing pollution. India has committed to reducing the carbon intensity of its GDP by 33% to 35% from 2005 levels by 2030, which includes efforts in the transportation sector.

In India, the transportation sector accounts for ~14% of GHG emissions and freight transport (trucks) accounts for more than 40% of final energy use in the transport sector. With ever-growing population and consumption, emissions are expected to further go up, unless steps are taken towards alternatives that are green and sustainable. Many of such alternatives have already achieved cost parity as opposed to legacy options, thereby providing a strong footing towards better adoption.

To help set a context for discussion among stakeholders, this thought leadership highlights key themes on green mobility and logistics, which are seeing traction in India, such as EV, e-buses, LNG fleet and green warehousing. It aims to highlight how these themes are changing the face of mobility and logistics, showcase key business models adopted by leading players, key enablers, government initiatives supporting these themes and private sector participation so far.

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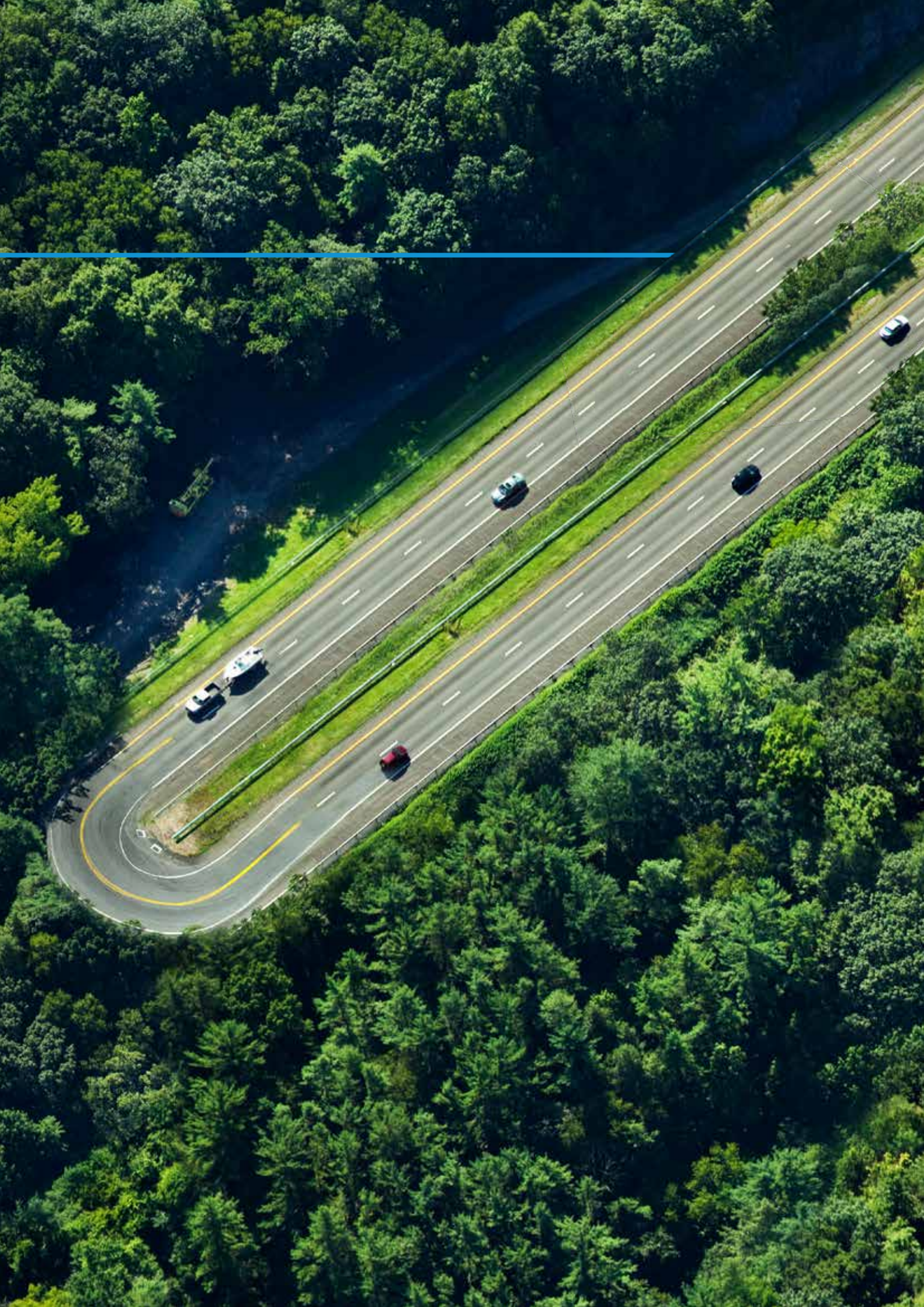

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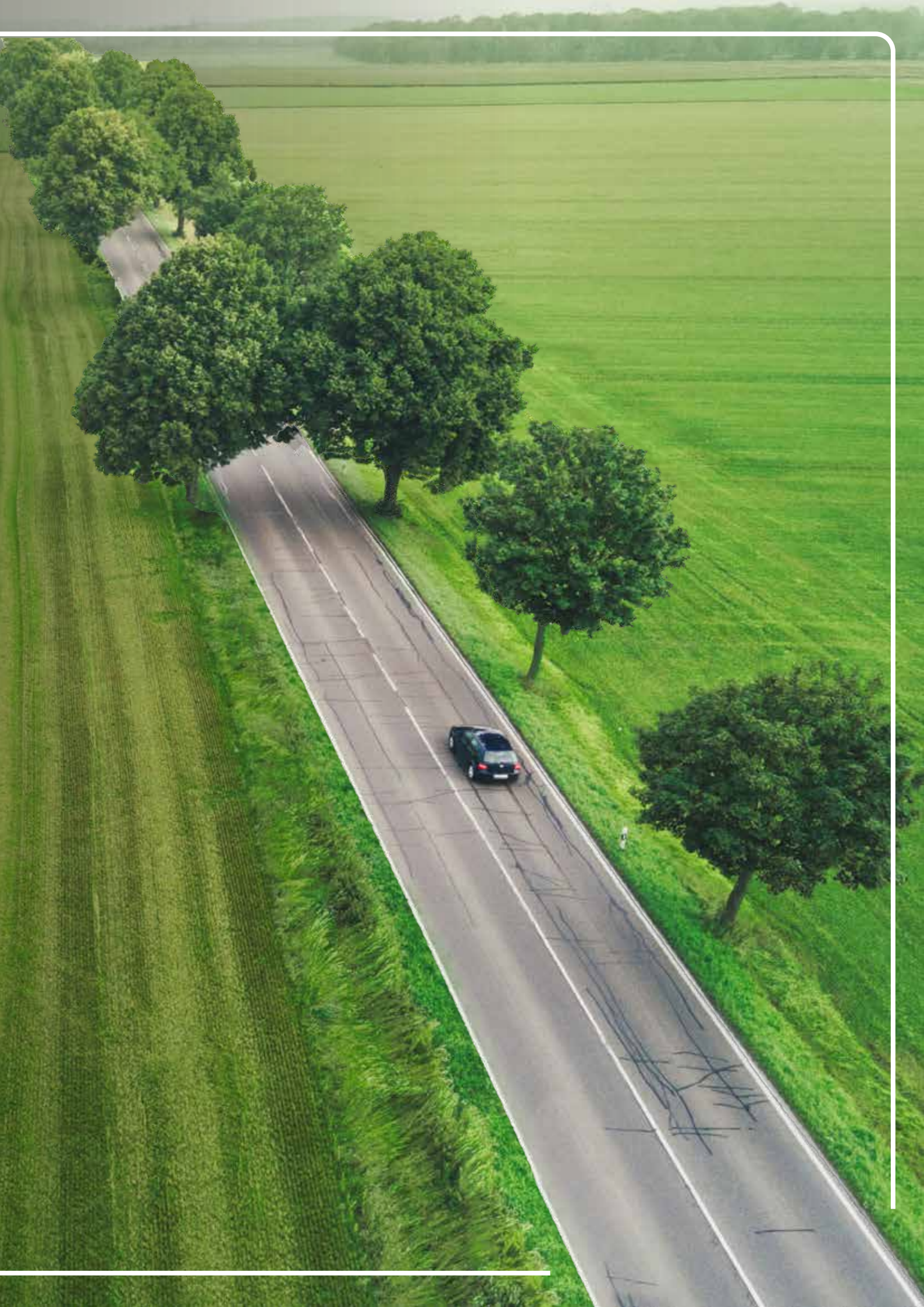


Executive summary

Mobility and logistics would play an increasingly important role in India's journey towards net zero emissions by 2070. In recent years, government policy has played a crucial role in developing this sector, creating a favorable market environment. It all started with subsidies, incentives and an environment enabling investments from private players in EV, which has led to growth in customer adoption. Now, the Government of India (GOI) and other stakeholders are turning their attention to electric buses for mobility and LNG trucking for freight to further boost sustainability initiatives. Further, industries must also enable green practices in warehousing and logistics to contribute from all ends.

Electric vehicles (EVs): The light motor EV market in India is expected to see substantial growth, with sales of two-wheelers and three-wheelers leading due to affordability and government incentives. Four-wheeler EV sales are also on the rise, supported by investments in charging infrastructure and financial support mechanisms. By 2030, the market is anticipated to reach 12.8 million units.

5x
Increase in sales of electric 2Ws from FY21 till FY24

US$2.7b
Funding Indian EV start-ups secured during FY18-FY23; >70% went to E-2W and E-3W

1st
India became the largest electric 3W market in 2023

Electric buses (e-buses): The electric bus market in India is projected to grow from US$0.86 billion in 2024 to US$2.83 billion by 2030. This growth is driven by GOI investments and targets for bus electrification, with various Indian states aiming for 100% fleet electrification by 2029-2030.

26% Less total cost of ownership (TCO) as compared to a similar capacity diesel buses

53% Lower operating expenses as compared to a similar capacity diesel buses

Liquefied Natural Gas (LNG) trucks: LNG fleet proves to be a strong alternative to legacy diesel trucks, owing to lower emissions and lower cost of ownership. This concept has already gained a lot of traction in China, where the penetration has reached ~15% of the new fleet addition. In India, leading companies in some of the key polluting sectors have already started using LNG fleet and realized benefits from it. As a result, the country is likely to reach its goal of a one-third LNG-powered fleet within 15 to 20 years.

INR 30/km TCO of an LNG truck with GVW more than 50 ton

24% Lesser emissions with LNG as compared to diesel

Green warehouses: India's logistics and warehousing sector is moving towards sustainable practices such as renewable energy, energy-efficient appliances and sustainable building material. Major warehousing developers are expanding green warehouses, which are also expected to fetch higher rentals. Further, financial institutions like SIDBI offer concessional loans to businesses implementing green practices, which aids the transition to green warehousing.

15-25% Operational cost reductions from green warehouse as compared to conventional warehouse of a similar capacity

7-10% Higher rental premium earned by a green buildings in India

Supportive infrastructure is key for future expansion

Public charging stations have rapidly expanded in India, with the number increasing nearly ninefold, from 1,800 in February 2022 to 16,347 in March 2024. Adopting innovative and customizable business models such as Battery-as-a-Service (BaaS) and bulk procurement are expected to drive the future of the e-bus and e-mobility landscape in India. Indian BaaS Market size was valued at US$12.67 billion in 2023, and the total India BaaS revenue is expected to grow at 13.2% from 2024 to 2030.

9x
Increase in public charging stations in India

US$30.19b
India's estimated Battery-as-a-Service revenue in 2030

1,700
LNG stations planned by national oil companies

In addition to planned LNG stations, there is a plan to develop small-scale liquefaction plants in off-grid areas. These plants will convert biogas into bio-LNG, offering an additional source of clean energy for the transport sector.

GOI has been instrumental in the adoption of green mobility in the country

Capital subsidies provided in FAME policies have incentivized the penetration of the electric vehicles (EV) market. Upcoming policy discussions are now heavily focused on evolving the EV infrastructure in the country, with the establishment of charging stations and promoting alternative such as Battery-as-a-Service, to support the EV market. States have set aggressive targets of e-bus adoption driven by GOI investments. Together, PM E-Drive and PSM schemes are supported by a substantial budget exceeding US$900 million, with the objective of deploying more than 50,000 e-buses by the year 2029.

GOI seeks to standardize LNG prices across the country, addressing varying costs due to state taxes. NITI Aayog recommends halving the VAT on LNG for heavy-duty vehicles from 10% to 5% to cut costs and boost uptake. The National Logistics Policy advocates for eco-friendly logistics, offering incentives for warehouses to implement sustainable practices. Few states offer subsidies to warehouses focused on sustainable energy use, waste recycling and water conservation.

The road ahead for mobility and logistics

India's rapidly growing EV industry is set to receive US$500 million of investment, enhancing the country's green mobility initiatives. Key focus areas of GOI and private sector include energy storage, clean technologies and e-mobility.

Achieving 100% adoption of electric buses is expected through greater involvement from the private sector. Private operators may find the electrification of inter-city buses appealing if they are offered favorable financial conditions, such as lower interest rates, longer loan terms, and guaranteed loan repayments. In support of India's LNG fleet initiative, international companies are anticipated to establish manufacturing facilities and LNG refueling stations across the country.

Although the penetration of green warehousing is low in India, but Grade A warehousing supply is expected to cross 300 msf by next year, emphasizing the importance of quality and sustainable infrastructure over cost.

These initiatives are part of a comprehensive strategy to decouple economic growth from carbon emissions, reinforcing India's commitment to a sustainable future in line with its economic aspirations and global environmental responsibilities.

01

Context and case for India

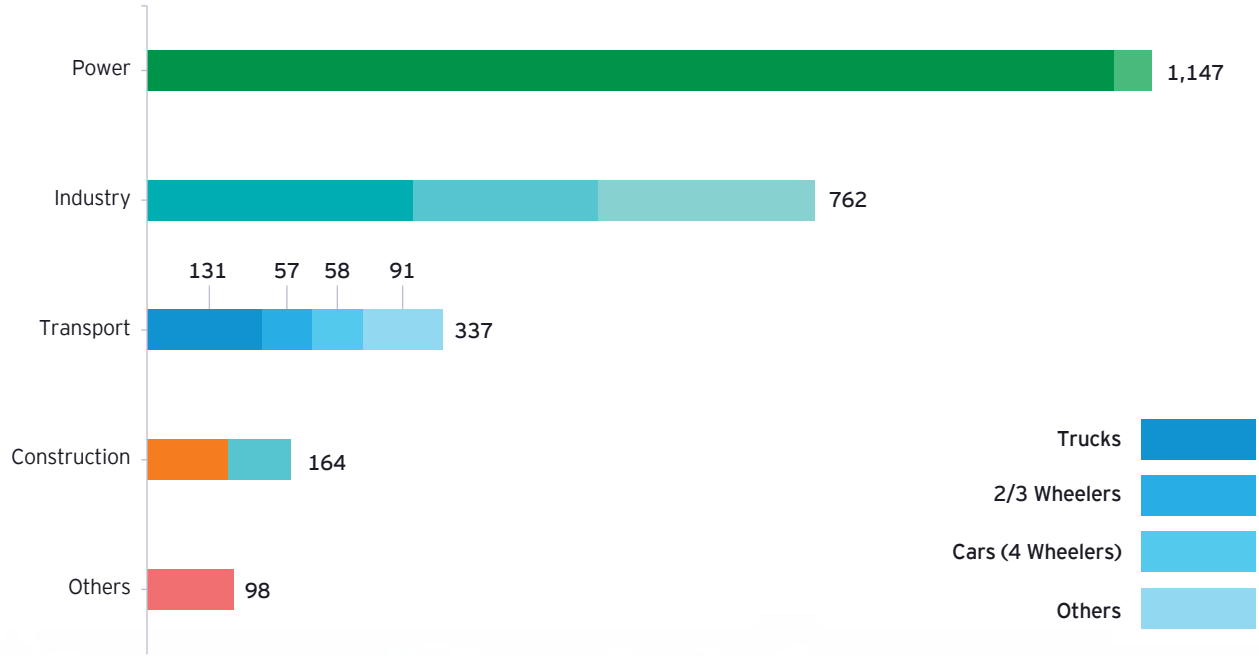
India's GDP is expected to grow to US$26 trillion by FY48, up from US$3 trillion in FY2024. Increasing domestic consumption, export or import of commodities and higher velocity of distribution will lead to growth in the Indian logistics sector. The logistics sector is expected to expand at an annual rate of 8.8%, reaching US$484 billion by 2029, up from US$317 billion in 2024.

India's logistics spend has been higher than that of developed countries at approximately 14% of GDP. The Government of India has laid out plans to improve infrastructure and reduce logistics spend through programs such as Gati Shakti master plan and National logistics policy. India currently spends INR26 lakh crore in logistics, where transportation has a large share of 75%. Road transportation accounts for almost ~70% of the overall market.

Further, at the 26th United Nations Framework Convention on Climate Change (COP 26) held in November 2021, India declared its ambition to reach net zero emissions by the year 2070. India has committed to reducing the carbon intensity of its GDP by 33% to 35% from 2005 levels by 2030, which includes efforts in the transportation sector.

India is currently grappling with the rising pollution levels in the transportation sector, and it is important to address it on an urgent basis. India's share of global emissions was about 7.4% of CO2 emissions from combustible fuels in 2022 and it is the third largest CO2 emitting country.

Figure 1: Trucks contribute to ~40% of the emissions from transport segment



Source: EYP Analysis

In India, the transportation sector accounts for ~14% of GHG emissions and freight transport (trucks) accounts for over 40% of final energy use in the transport sector

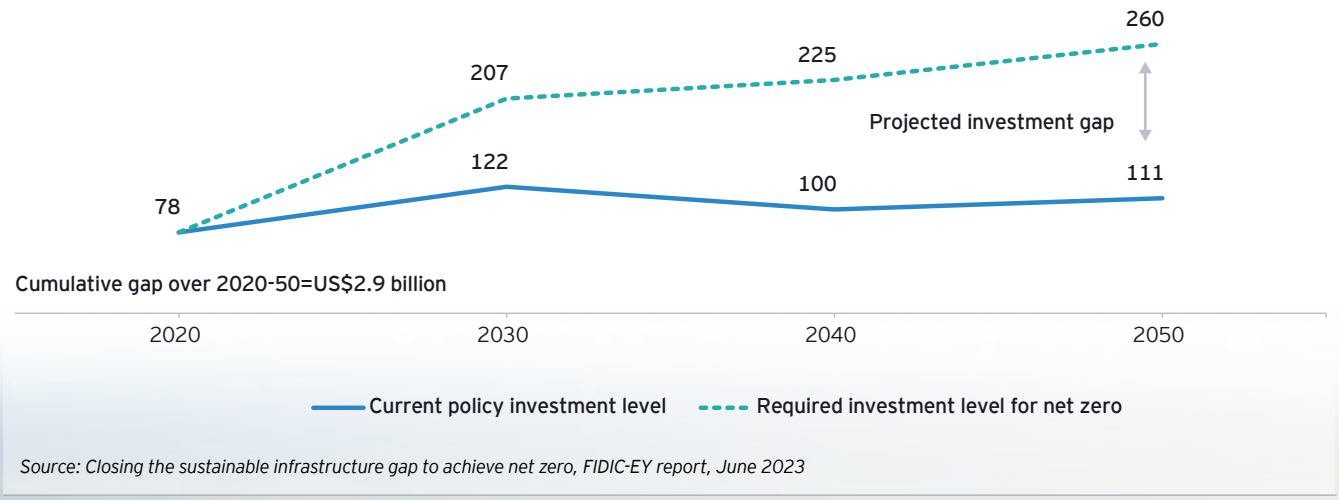
The emissions have increased over threefold since 1990, and it is anticipated to rise even more as India's urban population is projected to double by the year 2050. Traditional vehicles equipped with internal combustion engines (ICE) are the primary source for emissions. This highlights the urgent need for a shift towards cleaner, more sustainable modes of transport.

Many regions around the world have successfully implemented green mobility solutions for a cleaner environment. California reduced its CO2 emissions by 2.4% in 2022 relative to 2021. Over half of this decline was attributed to the transport sector, with an increasing sale of Electric Vehicles (EVs) over gasoline powered vehicles. In 2022, about 20% of all light-duty vehicles sold were EVs, and this number improved in 2023 with EVs making up one out of every four cars purchased. Emissions from transportation in Norway reached their highest level in 2012, at 15 million tons of CO2-equivalent, and reduced to 8.2 million tons of CO2-equivalent in 2019, owing to the country's drastic measures aimed at decarbonizing the transport sector.

India's current annual investment in sustainable infrastructure was US$78 billion as of 2020, of which sustainable transport investment# was US$945 million per year.

By 2050, the total investment in transport sector is projected to reach US$1.5 billion every year. However, to reach net zero by 2050, there exists a potential to reach annual investment of US$7.2 billion by 2050.

Figure 2: Net zero infrastructure financing potential in India (US$ billion)



Source: Closing the sustainable infrastructure gap to achieve net zero, FIDIC-EY report, June 2023

#Transport infrastructure include vehicles, trucks and other forms of transport and their supporting infrastructure

The multi-billion-dollar investment opportunity presents in many solutions across mobility and logistics, such as EV cargo fleet, e-buses, LNG Trucks and Green warehouses.

We expect these themes to strengthen further at the back of:

- **Favorable policies**
  Government policies, such as capital subsidies (FAME, PM E-Drive), production linked incentives (PLI for OEMs), process support (PM-eBus Sewa PSM) form the cornerstone of the green mobility push in India.

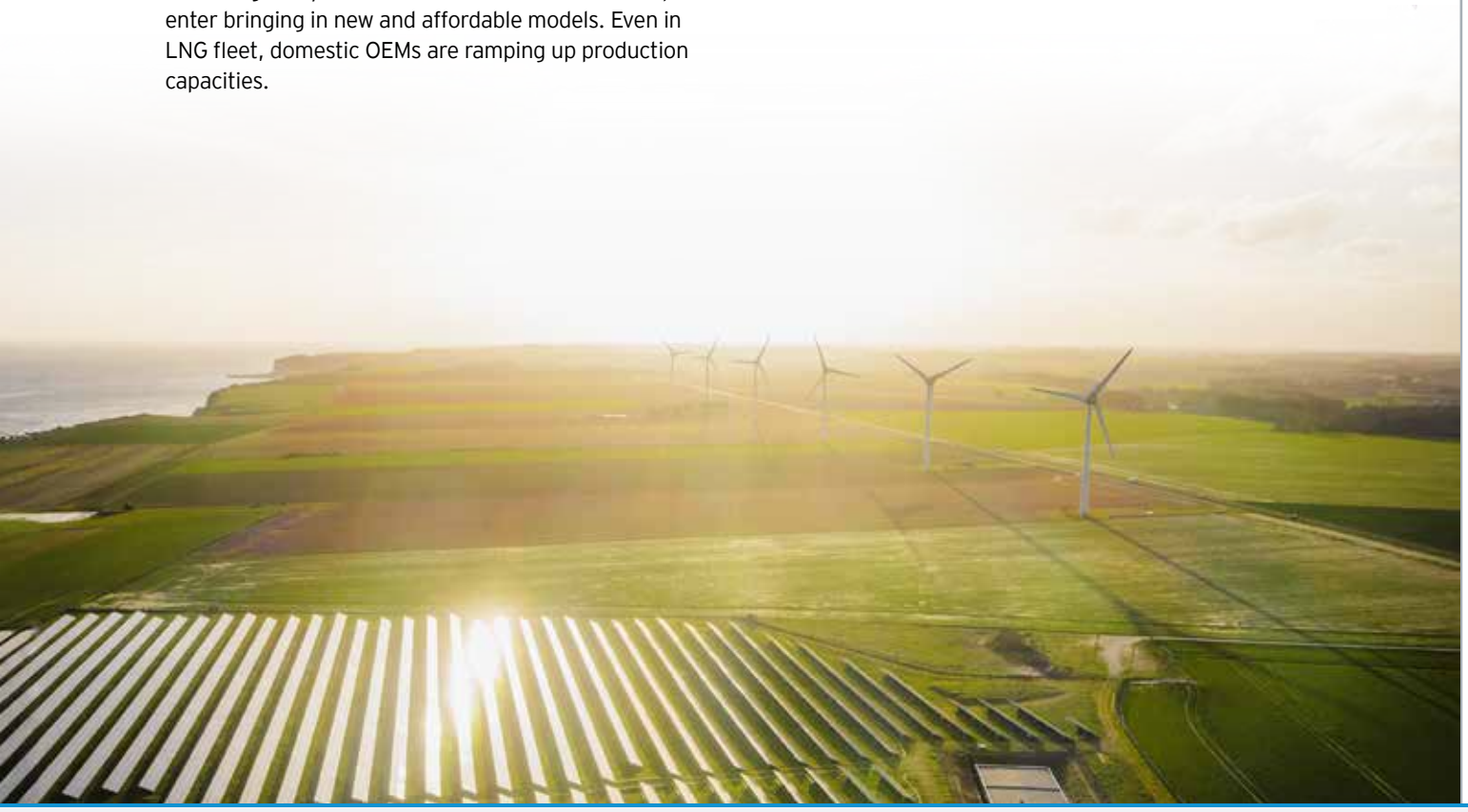
- **Cost of ownership achieving parity with legacy alternatives**
  Improving Total Cost of Ownership (TCO) of electric fleet has been a key driver for green mobility. The upfront cost of all EVs is higher than their ICE counterparts, but the costs start to reduce by the second year. In the long run, the TCO for electric 2W is INR1.4/km, electric 3W is INR2.5/km and electric 4W is INR6.24/km. TCO for an LNG truck is INR30 per km, whereas for a diesel truck, the per km ownership cost is INR41.

- **OEMs achieving the right balance between product features and affordability**
  Market is witnessing augmentation in options available to customers, aimed at providing higher value to customers with increased affordability. Many OEMs have entered the EV market in the recent past, both domestic and international. The market would gradually expand becoming a buyer's market as more and more companies enter bringing in new and affordable models. Even in LNG fleet, domestic OEMs are ramping up production capacities.

- **Organized fleet platforms are growing in scale**
  Organized fleet platforms are gradually increasing their share in the overall market, as customers are seeing value in better services, traceability, telematics, services and safety measures. Furthermore, these platforms are the ones who are taking steps in the direction of sustainability, including adding EV into the fleet and adoption of greener fuels.

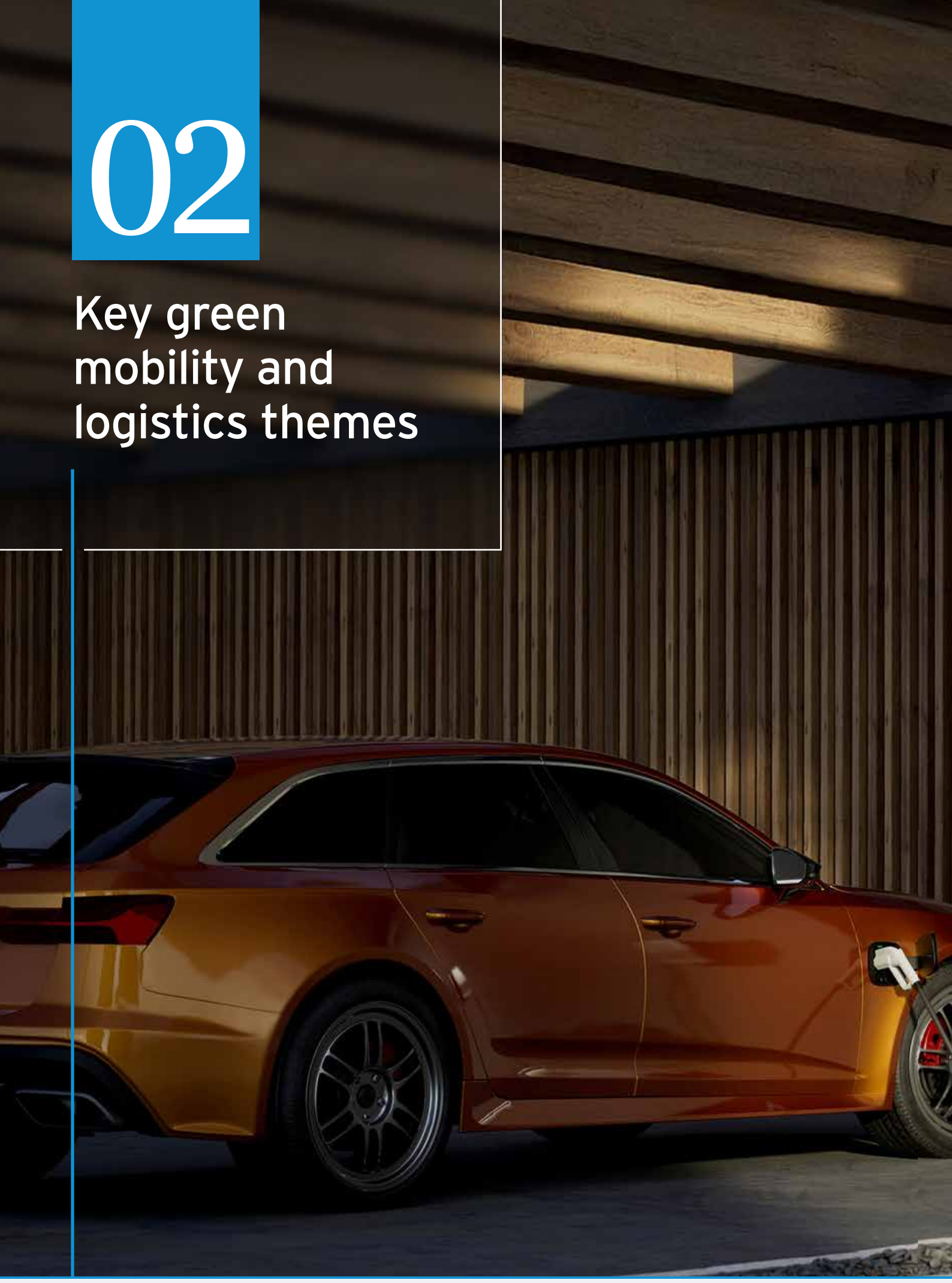
- **Innovative financing solutions**
  Lower interest rates through priority sector lending or government-backed schemes would not only incentivize fleet operators to transition to cleaner alternatives but also reduce operational costs, promoting a larger shift to sustainable mobility solutions. Organisations such as Small Industries Development Bank of India (SIDBI) provide loans at concessional interest rates to micro, small and medium enterprises (MSMEs) that are adopting energy-saving technologies.

In the upcoming sections, we provide an in-depth analysis of key green mobility and logistics themes, focusing on the market opportunity, growth drivers, government's role and preferred operating models. We are hopeful that this thought leadership will be able to generate interest in evaluating investment opportunities in these sectors.



02

Key green mobility and logistics themes



2.I Light motor vehicle (two, three and four wheelers)

EV sales are expected to reach annual sales of 12.8 million in FY30, with an overall vehicle penetration of 28%

The growth of EVs in the two, three and four-wheeler categories is due to multiple factors such as:

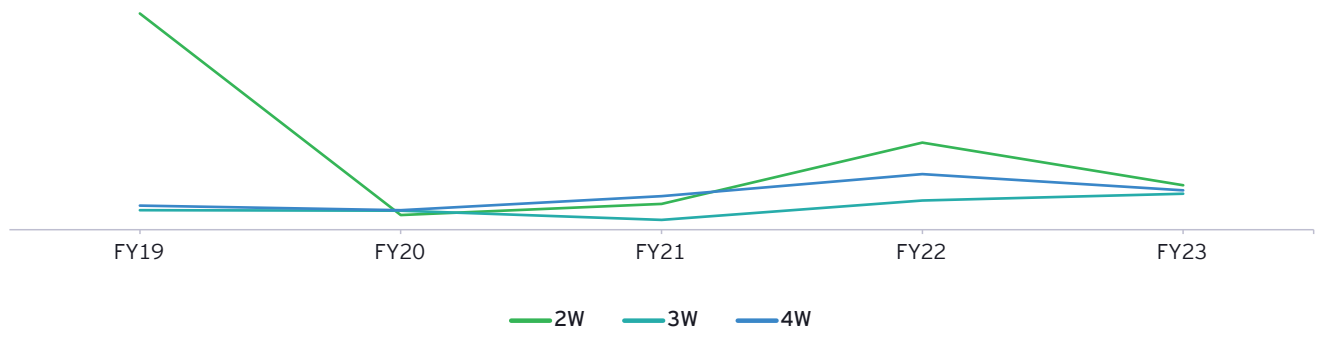
- Various policy incentives for electric vehicles, including purchase rebates, draft battery swapping policy and road tax waivers
- Financial support for investment in battery production and associated parts
- In addition to government incentives, the adoption of EVs is higher due to price sensitive Indian consumers in the context of higher fuel prices
- Private sector and start-up participation in the form of funding and R&D

Certain states are leading in EV adoption across India, including:

- **Delhi** has reached a 11.5% penetration rate for EVs, fueled by widespread adoption across various segments. With more than 2,400 EV charging stations already in place, the Delhi government plans to establish a network of at least 30,000 charging points throughout the city[1].
- **Kerala** has reached a 11.1% rate for EV penetration in December 2024. Electric 4W are driving Kerala's EV adoption with a sale of 2,803 units in the first quarter of FY25. The state has further plans to set up 2,000 EV charging stations by 2023 in collaboration with a charging station service provider[2].
- **Maharashtra** held a leading position in 2023 with the highest number of electric two wheelers and e-buses, along with 26,000 e-car registrations. The state has a total of 3,079 operational charging stations, one of the highest in the country[3].
- **Uttar Pradesh** boasts the country's largest fleet of BEVs, with around 18,300 electric vehicles on the road. The state leads in 3W passenger electrification, with about 84% of this category electrified[4].
- **Karnataka** had a 9.3% EV adoption rate in FY24, with over 300,000 electric vehicles, and 5765 charging stations. The state has recently committed to add 2500 more stations to drive the sustainable objectives[5].

The penetration of EVs has shown an increase since the pandemic across 2W, 3W and 4W segments.

Figure 03: Increasing EV sales in small motor vehicles



Source: Society Of Manufacturers Of Electric Vehicles (SMEV)

Two-wheelers are the most popular EVs on the Indian roads, holding about 90% share of the market by vehicle type

The sales of electric 2Ws has increased by approximately five times from FY21 till FY24. Four major private sector fleet operators control more than 80% of the market, the largest of them has close to 35% share. Sales are expected to continue to grow as battery prices go down and vehicles become more affordable.

3Ws EV sales in India grew at a compounding annual growth rate of 45% From FY20-FY24. Three-wheeler (3Ws) sales in India have been robust for many years, with hundreds of thousands sold annually since 2012, with the only exception was in 2020, when the pandemic caused sales to drop to 30% of the previous year's volume. Lower TCO and supportive incentives under FAME II have been instrumental in making India the largest 3W electric market, surpassing China in 2023.

Although electric four wheelers (4Ws)'s penetration is the lowest as compared to 2Ws and 3Ws, the sales of electric 4Ws have witnessed a compound annual growth rate of close to 150% in the last five years. The trend has been driven by purchase incentives from the FAME II initiative, supply-side incentives from the PLI scheme, tax advantages, and the Go Electric campaign. Several newer models and international OEMs entered the Indian market in the last couple of years, thereby providing more options for the consumers. However, the domestic OEMs have had a strong foothold in the market with 80% share in EV sales.

A large portion of EV 4Ws sales has been driven by car purchases by commercial fleet operators. Almost 50% of the cabs plying on the India capital's road are electric vehicles. The growth story of EVs continues as the penetration of EVs is expected to accelerate by FY30 across 2W, 3W and 4W segments.

Table 01: EV sales by vehicle segments (in '000 units) and EV penetration in total vehicle sales (%)

Vehicle type	FY23		FY27		FY30	
	%	No's	%	No's	%	No's
Two-Wheeler	15%	729	35%	3,240	62.9%	10,643
Three-Wheeler	6.7%	31	38%	274	62%	492
Cars (Four-Wheeler)	1.2%	48	6.8%	316	17%	1,106

Notes and assumptions: Excludes swappable battery vehicles, excludes e-rickshaws. Historical vehicle sales and current EV penetration across vehicle segments have been sourced from the Vaahan portal. Growth across vehicle segments is estimated using growth of the end-use sector. EV penetration is estimated based on the TCO benefits, global benchmarks of the adoption in the use cases.

Source: EYP Analysis

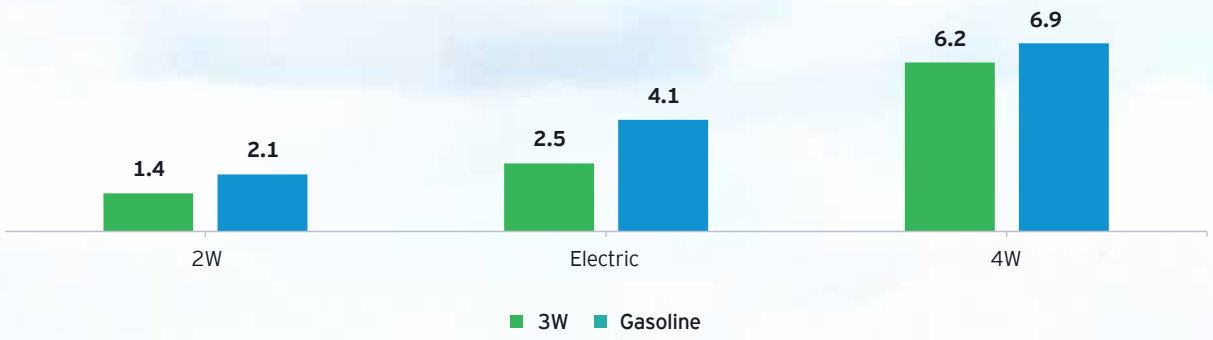
Lower total cost of ownership (TCO) is a major reason for higher adoption rate of 2Ws and 3Ws in India

The TCO is lower for both electric 2Ws and 3Ws, while for the 4Ws, the difference is not substantial. Hence, the adoption of the latter has been slower than the other two. More competition in the EV market can enable lower upfront costs and better charging infrastructure can lead to continuity of the increased demand.

In comparing the TCO for electric and gasoline vehicles across 2W, 3W and 4W (see figures 2 and 3), it is evident that while EVs have higher upfront costs, they boast significantly lower running costs:

- For instance, the upfront cost for a 2W electric vehicle is INR1.63 lakh, compared to INR98,040 for its gasoline counterpart. However, the running cost for the 2W electric is only INR9,250 versus INR50,030 for the gasoline version.
- This trend persists across all categories, with EVs showing lower total costs and average TCO over their lifetimes.
- Notably, the average TCO for a 4W electric is INR6.24/km, compared to INR6.96/km for a gasoline vehicle, indicating more favorable long-term economic benefits for EVs.
- The substantial savings in operational costs make EVs a more cost-effective and sustainable choice despite the initial higher investment.

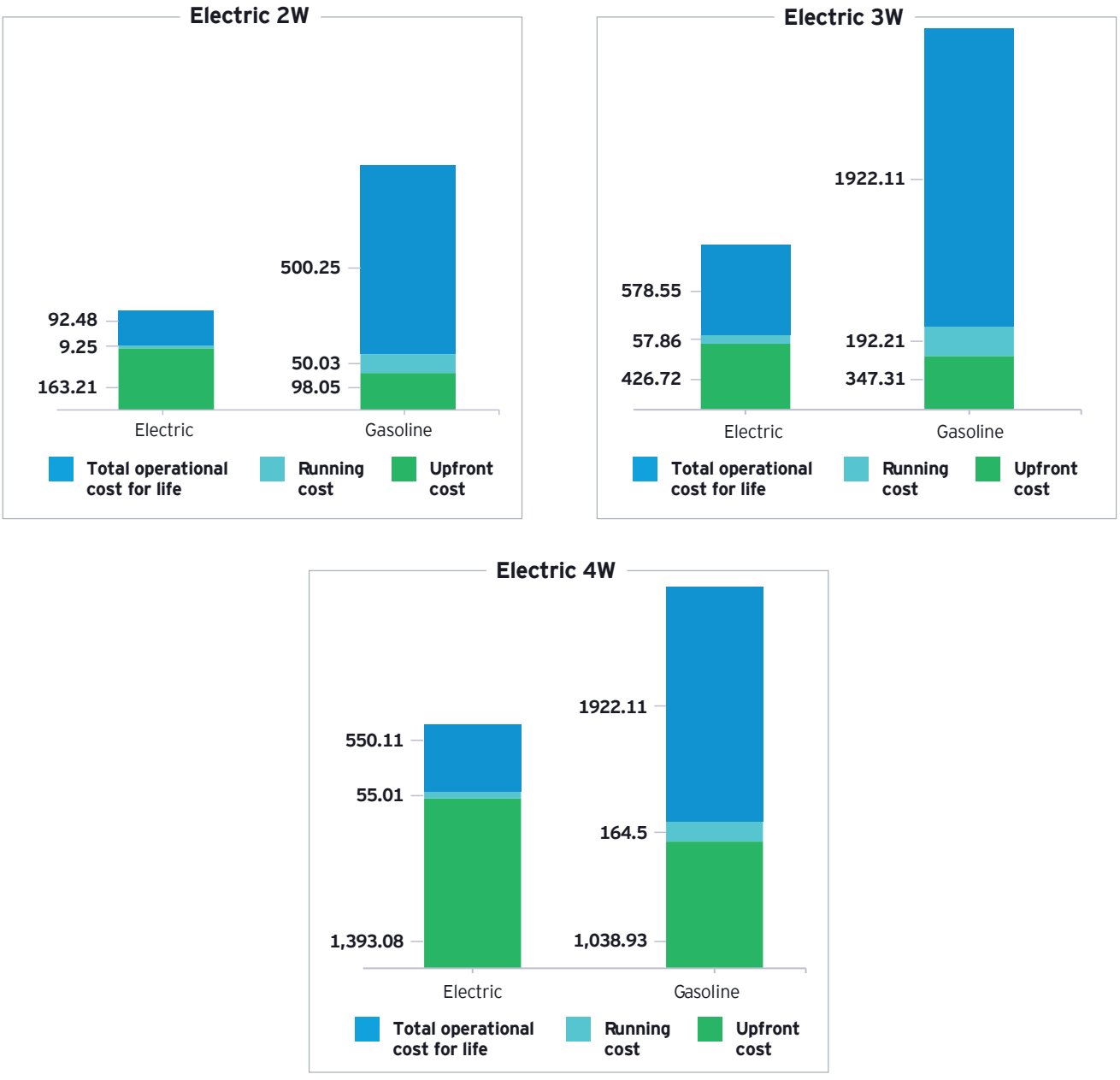
Figure 04: Average TCO comparison of electric two, three and four-wheeler EVs (INR/km)



Note: Average prices of best-selling models have been considered. Average range cars have been considered for the analysis. luxury cars have been excluded from the analysis. For 2W, lithium ion battery vehicles have been considered.

Source: Secondary research; WRI India

Figure 05: Different cost comparison of 2W, 3W and 4W in India (INR'000)



Note: This analysis uses average prices of top-selling models and average-range cars, excluding luxury vehicles and focusing on two-wheeled lithium-ion battery vehicles with a 10-year lifespan assumption for total cost calculations.

Source: Secondary research; WRI India

Various business models have emerged to cater to the growing demand for EVs, each with its unique approach to ownership, operation and service delivery.

Table 02: Preferred business models for two, three and four-wheeler EVs

Business Model	Description	Fleet owner examples	Growth trends
▪ Ownership-based model	Fleet owners purchase EVs outright and manage operations independently	BluSmart, Uber India (Uber Green)	▪ Moderate growth due to high upfront costs; viable for large players with capital
▪ Leasing model	Fleet owners lease EVs from manufacturers or leasing companies	Revfin, Lithium Urban Technologies	▪ High growth driven by reduced financial barriers and demand for flexible ownership
▪ Pay-per-use model	Fleet owners pay a fee based on vehicle usage, reducing financial risks	BluSmart (for shared logistics use cases)	▪ Emerging model with significant potential in cost-conscious small businesses
▪ Battery-as-a-Service	EVs are purchased/leased without batteries; fleet owners use battery-swapping services	Sun Mobility, Bounce Infinity	▪ Rapid growth as battery costs remain a major challenge; supported by increasing swapping infrastructure
▪ Integrated charging model	Fleet owners establish their own charging infrastructure for EV operations	Amazon India (with in-house charging for its EV delivery fleet)	▪ Steady growth for large players focusing on operational control and sustainability
▪ Aggregator model	Multiple fleet owners share vehicles and charging infrastructure under a common platform	EVage, MoEVing	▪ High growth as smaller players look for economies of scale and cost efficiency ▪ The smaller players are able to generate substantial revenues

Source: Secondary research, EYP Analysis

Government incentives in the form of loan subsidies and lower GST has been a key factor in increasing EV sales

GOI plans and policies are providing a major push towards EV adoption in India. Some of the key initiatives include:

- GST on EVs reduced from 12% to 5% as of December 2023
- The Ministry of Road Transport & Highways (MoRTH) announced green license plates for battery-operated vehicles and exemption from permit requirements
- MoRTH issued a notification advising states to waive road tax on EVs to lower initial purchase costs
- States such as Uttar Pradesh and Tamil Nadu offer 100% waivers on registration fees for strong hybrid and plug-in hybrid EVs, making it financially attractive to customers and creating better opportunity for manufacturers to produce these vehicles

EV charging infrastructure is playing an important role in the increased adoption of EV in India

EVs are expected to grow from 0.8 million in FY23 to 13 million in FY30 and are expected to propel the demand for EV charging stations (EVCS). The Charing Point Operators (CPOs) in India have ambitious plans to set up over 100,000 EVCS by FY27[6]. CPOs have formed partnerships with B2B fleet players to ensure utilization, and with real estate players to access key areas.

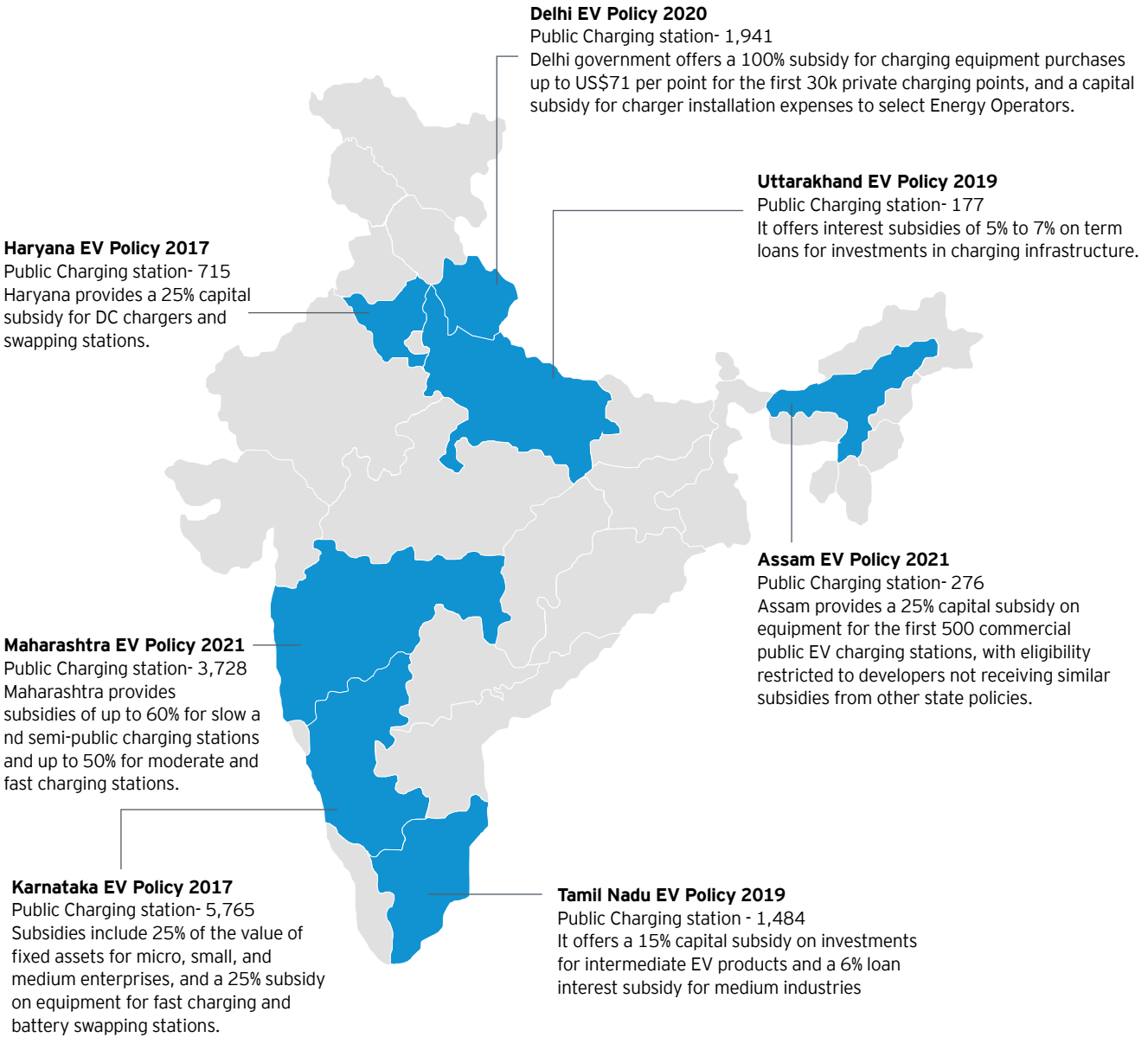
Advancement in battery technology and growth of fast charging will further fuel demand for efficient charging infrastructure. There has been a rapid expansion of public charging stations in India. The number increased nearly ninefold, from 1,800 in February 2022 to 16,347 in March 2024. Most of the public/semi-public chargers are slow chargers and the 2Ws and 3Ws have witnessed a noticeable increase as they primarily rely on Alternate Current (AC) slow charging and battery swapping. The market is fragmented with the presence of multiple players across AC and DC charger solution categories.

GOI is playing a crucial role in establishing a comprehensive charging infrastructure nationwide through its plans and policies. The FAME schemes have been instrumental in increasing the EV adoption in India. GOI made an investment of US$125.6 million under FAME II scheme to spur an increase in charging infrastructure[7]. The PM e-drive scheme aims to support deployment of 72,300 public charging stations (PCS) through an INR2,000 crore allocation. Of these, 48,400 EV charging stations will be for 2Ws and 3Ws.

As per the New EV Charging Policy, GoI has announced, at least 1 station every square kilometer by the end of this decade, major highways and expressways will feature fast-charging stations every 100 km and the cost of electricity for these stations remains below the average supply cost (ACoS) until March 2028.

Along with central subsidies, state governments are also offering incentives to build a modern EV charging infrastructure in India:

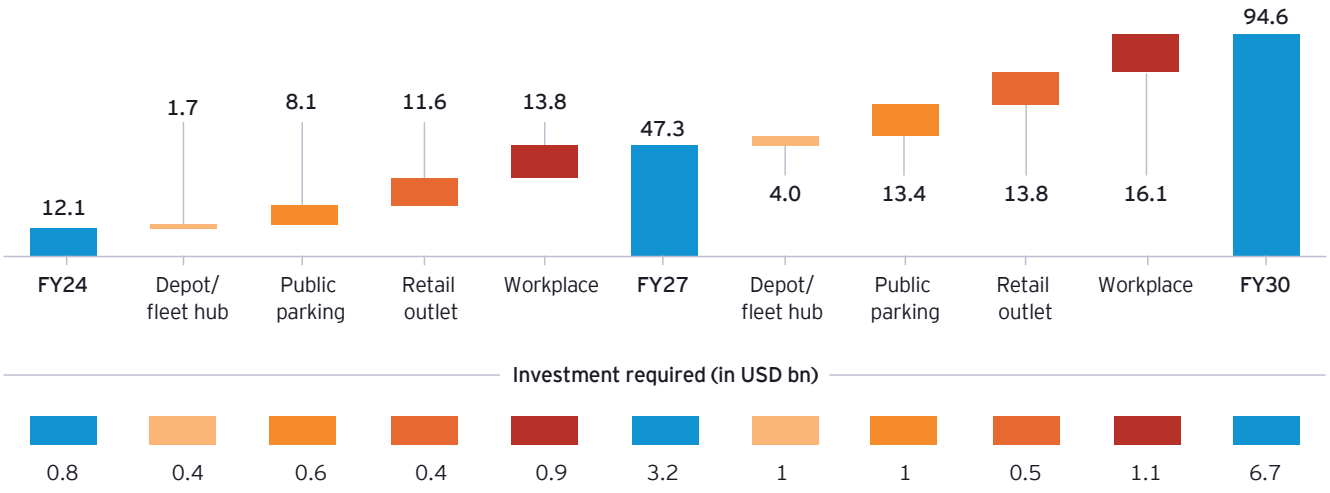
Figure 06: Policy incentives provided by state governments for EVs



Source: EYP Analysis

Logistics and OEM companies are partnering with state governments to build smart battery infrastructure (including battery swapping). According to the action plan devised by the Bureau of Energy Efficiency (BEE) for the establishment of Public Charging Stations (PCSs) in nine major cities, there is a goal to set up a total of 46,397 PCSs across these urban centers by 2030. A total of 94,000 charging stations are estimated to be required till FY30 to cater to 38.7 million EV parc requiring investment of US$6.7 billion.[8]

Figure 07: Cumulative EV charging station addition across select locations (in '000 units)



Notes and assumptions: Current charger population is based on the primary and secondary sources. Growth of charging stations across formats is based on the charging preferences of the EV use cases. Capex includes chargers, civil and electrical infrastructure across configurations.

Source: EYP Analysis

Private sector has accelerated investments in R&D to keep pace with changing technology

The OEMs are investing billions in R&D to support the development of new EV models, charging system and advanced battery technology.

Between 2018 and 2023, Indian EV start-ups secured a total funding of US$2.7 billion, with more than 70% of this amount dedicated to electric two-wheelers and three-wheelers[9].

Start-ups EV funding in India more than doubled from 2021 till 2022 (from US$765 million to US$1,660). There were four investment rounds exceeding US$100 million in 2022, an increase from just two such rounds in 2021. Late-stage investments in the sector climbed by 124% to reach US$1.02 billion in 2022. Similarly, early-stage funding experienced a significant boost of 160%, growing from US$202 million in 2021 to US$526 million in 2022.

The e-mobility sector received FDI of ~US$32 billion between 2000 and 2022, of which, US$6 billion was received in 2021 alone. The projected FDI in EVs is expected to reach US$40 billion by 2030.[10] [11]

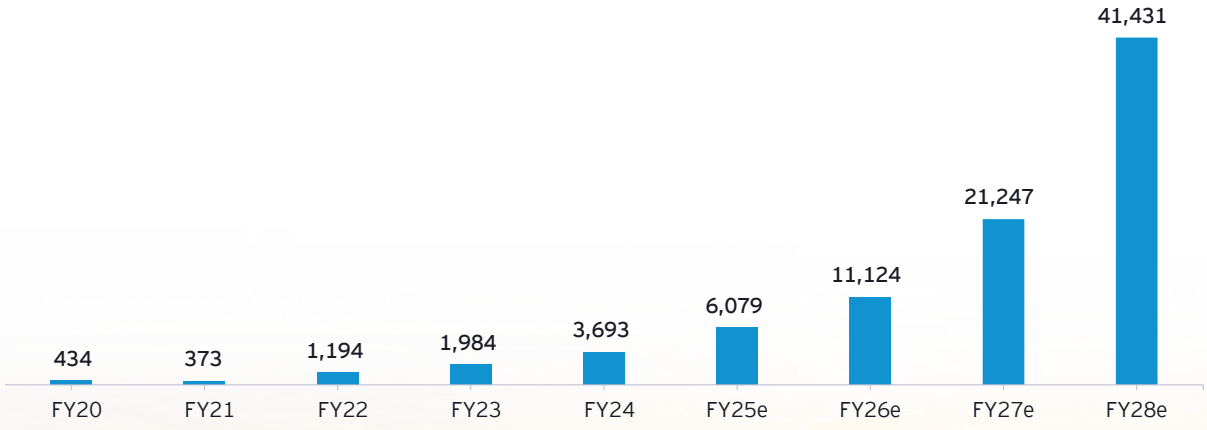
Together, with enhanced government support, greater private sector involvement, advancements in battery technology, heightened consumer awareness and more financing options, the future of the Indian EV market looks promising.

2.II Electric buses (e-buses)

India's e-bus market is projected to reach US$900 million by 2030 on account of annual/ registrations increasing to over 40,000 units in a year[12]

India's e-bus market generated a revenue of US$282.7 million in 2023, which is poised to grow at an annual rate of 18.2% during 2024-2030 to reach around US$900 million by 2030. In the last five years, ~7500 electric buses have been registered in India, with more than 50% of the registrations in FY24. The annual registrations are projected to reach 40,000 units per year by 2028. Government initiatives, demand for cleaner fuel, advancement in technology and increase in coverage of charging infrastructure will help accelerate the growth in the e-buses in India.[13]

Figure 08: Electric buses sales, historical and projected (FY24 to FY29) in units



Notes: Current e-bus fleet size is estimated based on tenders awarded by the STUs and central govt. agencies.

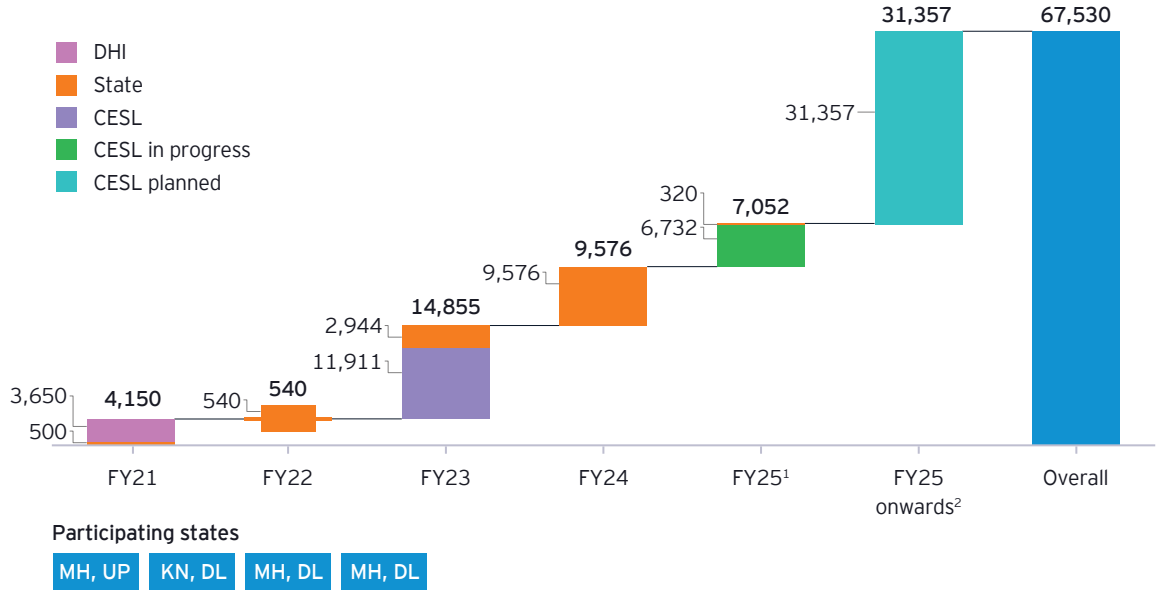
Source: EYP Analysis

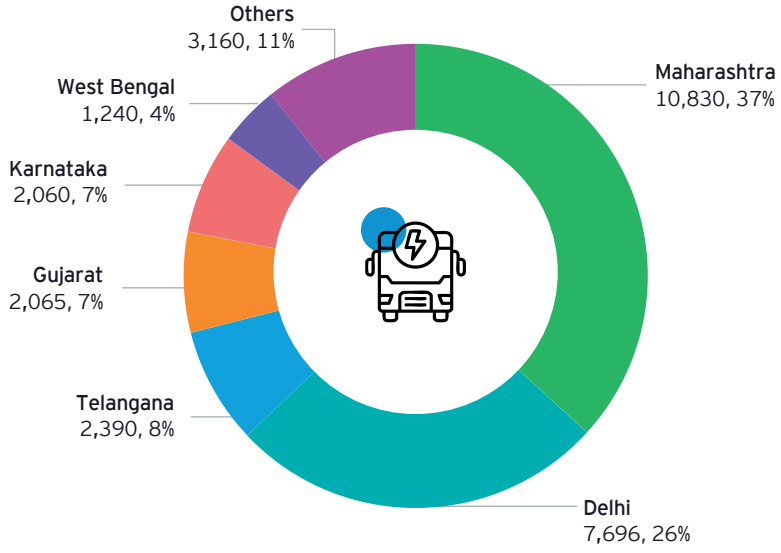
In FY24, the sale of e-buses surged 80% YoY reaching over 3600 units. This has been driven primarily by public sector entities, including State Transport Undertakings (STUs). The STU segment is expected to witness exponential growth in the coming years.

States have set an ambitious target of 90,000 e-buses wherein multiple states like Karnataka, Andhra Pradesh, Telangana and Kerala are targeting 100% bus fleet conversion to electric buses by 2030. Other states are expected to set a similar target and therefore e-buses requirement by different states will emerge as a major push for the demand of electric buses in India in the next five to seven years.

By FY24, ~29,000 buses have been tendered out by DHI, CESL and states. CESL plans to further tender another 38,000 buses in the next five to seven years). Out of ~29,000 buses tendered, Maharashtra and Delhi contributed to more than 60% tenders accounting for over 18,000 buses.

Figure 09: E-bus tenders in India





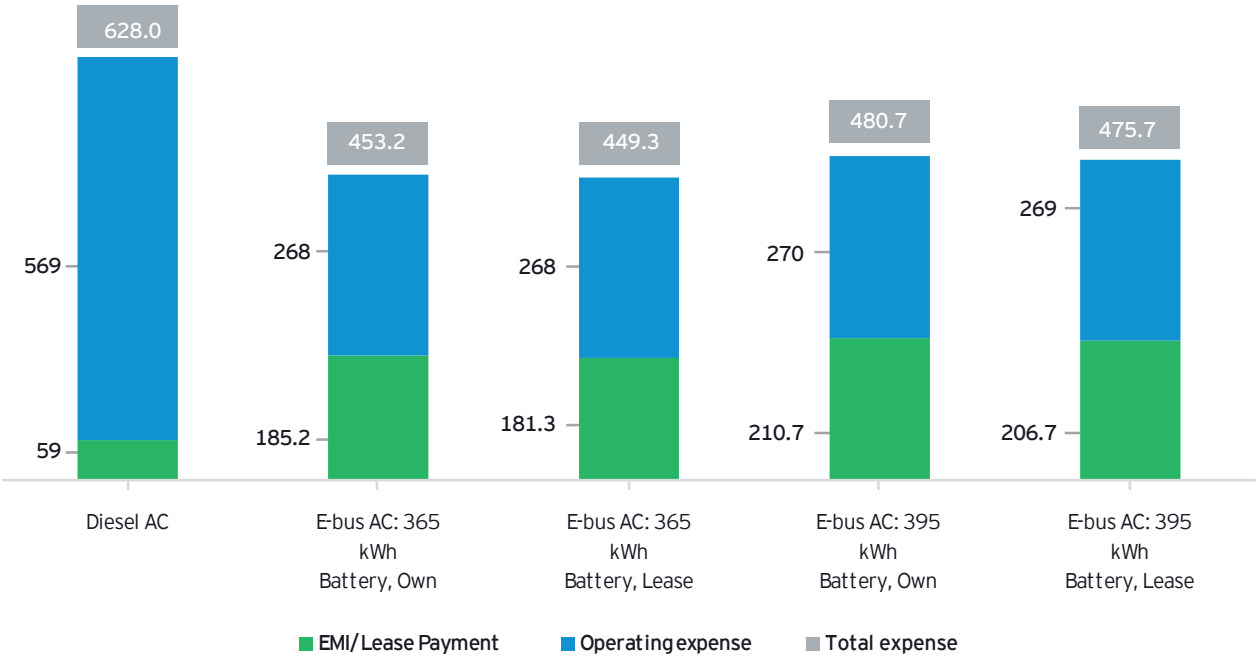
Source: EYP Analysis

The penetration of electric buses in the Indian bus segment is projected to reach 15% to 18% by 2029-30 due to 26% lesser Total Cost of Ownership (TCO) as compared to a similar capacity diesel bus

The lower Total Cost of Ownership (TCO) of e-buses compared to diesel buses is one of the leading factors for increased adoption of e-buses in India:

- TCO over a projected service life of 15 years: TCO for an e-bus is estimated to be approximately 15-20% less than that of ICE and CNG buses, with the cost recovery being achieved within six to seven years.
- TCO for a particular Km range: When evaluating the TCO for e-buses that travel for extended distances, the economic benefits become even more pronounced. For e-buses covering a daily range of 250 km, the TCO is 26% less than that of diesel-powered buses. This advantage escalates to 31% for e-buses traveling 300 km per day.

Figure 10: TCO analysis of AC diesel and e-bus basis different types of ownership in India (INR'000)



Notes: TCO accounts for capex (upfront payment, lease/EMIs, battery replacement) and operating expenses (fuel, maintenance, insurance, AMC, manpower costs) over the lifetime of the vehicle

Source: International Transport Forum, OECD. Bus model considered is Olectra C9, 12m AC.

Further, there has been an increased adoption of electric buses due to following factors:

- Sustainability commitment: Many cities are adopting e-buses as part of broader sustainability initiatives. For example, Delhi public bus service body aims for a 100% electric fleet by 2030 to tackle severe air pollution in the city.
- Technological advancements: Modern electric buses use advanced batteries that offer longer life, better safety and faster charging capabilities. Further, electric buses are equipped with IoT and telematics systems, enabling predictive maintenance, real-time monitoring, and optimized fleet management.
- Operational efficiency: Electric buses have fewer moving parts as compared to a diesel buses, leading to reduced mechanical wear. Further new electric buses are equipped with regenerative technology that allows energy recovery during braking, improving energy efficiency and extending battery life.

GOI incentives of over US$8 billion in the form of subsidies and grants are another driving factor behind the adoption of e-buses in India. Examples of government incentives are provided below:

The e-bus market in India is rapidly growing with a push from key GOI initiatives including, FAME II, PM Electric Drive Revolution in Innovative Vehicle Enhancement (PM E-DRIVE) scheme, PM e-Bus Sewa scheme and PM-eBus Sewa-Payment Security Mechanism (PSM) scheme. Collectively, PM E-Drive and PSM schemes are supported by a substantial budget exceeding US$900 million, with the objective of deploying 52,000 e-buses by the year 2029.

Table 03: Allocation of funds towards e-buses in EV promotion

Scheme	Outlay (US$ million)	Number of buses
FAME II (FY20-24)	378.6	7,090
PM E-DRIVE (FY25-26)	518.0	14,038
PSM (FY25-29)	405.2	38,000
PM e-bus Sewa	6,797.7	10,000

Source: Secondary research

The FAME policy, spanning nine years in two phases, subsidized 1,321,800 electric vehicles with a total of US$1.4 before concluding on 31 March 2024. It was replaced by the PM E-Drive Scheme in 2024.

PM E-Drive Scheme

- CESL will consolidate demand for electric buses in nine cities with populations over 4 million under the PM E-Drive scheme. The cities include Delhi, Mumbai, Kolkata, Chennai, Ahmedabad, Surat, Bangalore, Pune and Hyderabad.
- The scheme also supports intercity and interstate electric bus services in partnership with state governments.
- The scheme allocates 40% of its funds for electric bus deployment via capital asset grants, with the grant amount being the lowest of either US$118.2 per kWh of battery capacity, a size-based maximum incentive, or 20% of the cost from competitive bidding.

The PSM Scheme

- The scheme allocates US$429.4 million to support the procurement and operation of over 38,000 electric buses by (Public Transport Authorities) PTAs from FY24-25 to FY28-29, with a service period of up to 12 years.
- A Payment Security Mechanism is established to ensure timely payments to electric bus manufacturers and operators, mitigating payment delay risks.
- The scheme also includes a dedicated fund to act as a buffer for payment uncertainties, providing financial assurance to operators and encouraging wider participation in e-bus deployment.

For India to achieve future targets in the e-bus segment, there are many enablers and key learnings from global use cases that India can be incorporated into the ecosystem.

Learnings from global use cases such as financing incentives, market readiness, public-private coordination can help India accelerate e-buses growth

China is the world's largest market for e-buses, making up 95% of global stock.

The early adoption of a rapid and widespread electric bus network in China, backed by strong policy support, gave manufacturers confidence in setting up production lines and stepping up research. By 2022, China built the world's largest charging network, with 1.8 million public charging stations (two-thirds of the global total) and 3.4 million private charging stations. This means that, on average, there is one charging pillar for every 2.5 of China's 13.1 million new energy vehicles.

There are multiple programs in China that provide capital support to help drive the adoption of e-buses in the country. The EV Subsidies incentive program announced an extension in 2023 by renewing a substantial tax incentive package of US$72.3 billion over a span of four years. All electricity vehicles that are purchased in 2024 and 2025 will be eligible for complete exemption from purchase tax, which could amount to a maximum US$4,170 per vehicle. Starting from 2026 until 2027, the exemption will be reduced by half and capped US$2,078. India can learn from the fiscal incentives in China that are instituted on a large scale.

Europe, another area of significant growth, offers valuable lessons for India. The European electric bus market experienced a remarkable surge in registrations in 2023, with a 53% growth in 2023.

A total of 6,354 electric buses were registered across EU27, Norway, Iceland and Switzerland. Notably, over 42% of city buses now operate as zero-emission vehicles. This is due to strong government subsidies by countries in the European subcontinent.

Battery-as-a-Service (BaaS) can help drive the future of the e-bus and e-mobility landscape in India

Battery-as-a-Service (BaaS) is becoming a key factor in promoting the adoption of electric buses (e-buses) in India by mitigating high initial costs and concerns about battery longevity. BaaS models allow operators to lease batteries instead of buying them. This significantly lowers the upfront CAPEX of e-buses, which is crucial since batteries account for 40% to 50% of the vehicle's cost.

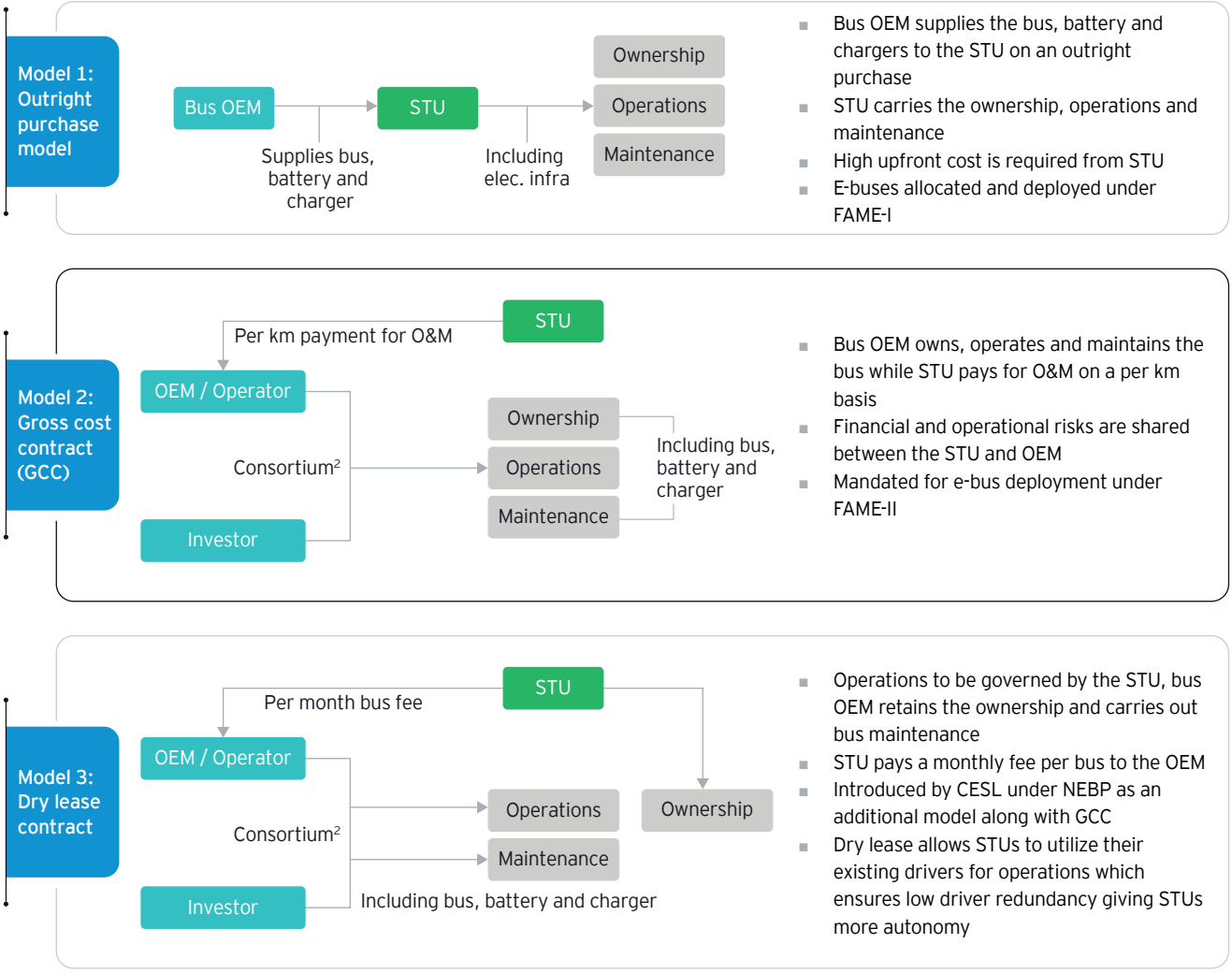
Operational benefits are also evident with battery swapping stations, which help minimize downtime. Considering India's vast network of over 2 million buses and 26,000 private operators, establishing a standardized and interoperable battery ecosystem is essential for seamless operations. Usage-linked leasing solutions, like those seen in the Chinese market, are being developed to support this shift. The BaaS model also helps with battery lifecycle management and cost reduction.

BaaS is prevalent in the e-bus segment. For example, a major EV charging infrastructure company in India has rolled out a new battery passport system, paving the way for Battery-as-a-Service (BaaS) for commercial vehicles such as electric buses and trucks in India. This system is designed to track a battery's lifecycle through comprehensive data collection at every stage.

There are favorable business models that can help in enabling potential returns in the e-bus sector. The most prevalent model followed by STUs is gross cost contract (GCC), which removes the upfront capex by the STUs and provides competitive per km rate.

Service providers are also able to work in the GCC model at competitive cost due to the revenue and tenure assurance offered by the STUs.

Figure 11: Operating models under e-bus tenders in India



Source: EYP Analysis

The GCC model offers higher flexibility to the authorities in offloading the operation and maintenance of e-buses and ancillary infrastructure to the operators.

Figure 12: Key features of the GCC model

Parameters	Operator	STU
Fleet operation and maintenance	✓	
Charging Infrastructure	✓	
Civil works and electrical infrastructure	✓	
Electricity costs	✓	
Manpower	✓	
Route selection		✓
Depot maintenance		✓
Land and parking area		✓
Fare collection		✓

Source: EYP Analysis

India's ambitious bus fleet transition targets require an investment of US$7.8 billion in debt financing. The private sector will play a crucial role in achieving 100% penetration targets

Foreign direct investment (FDI) is allowed in the electric bus (e-bus) sector in India under the automatic route, with full ownership permitted. The government has also introduced several schemes to promote the manufacturing of electric vehicles (EVs) in India, including lower import duty, exemption of social welfare surcharge and capital subsidy. Foreign capital would make an enormous difference in increasing adoption.

A few recent key investments from the private sector include:

- In 2024, a diversified financial group introduced a platform for providing bus and car fleet electrification, financing, fleet management and charging solutions with a significant investment of US$1.5 billion over a decade.
- In 2024, an e-bus manufacturer and a multilateral financing institution joined hands to facilitate the procurement of up to 650 e-buses, covering operation, maintenance and the development of depots and charging infrastructure, backed by an investment of US$43.2 million.

2.III LNG Trucks

We expect the LNG fleet market to reach US$26 billion at the back of ~64,000 LNG trucks by 2030

The heavy duty truck segment has an estimated market size of US$73 billion.

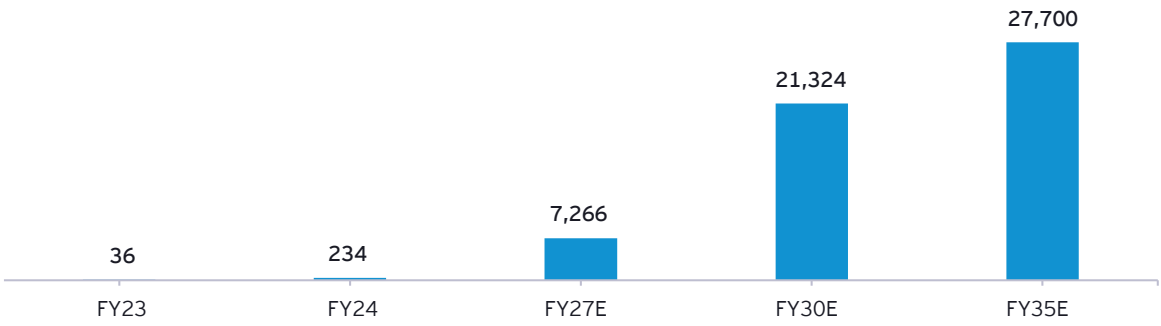
Approximately 70% of India's freight is transported by trucks, a sector that is expected to expand fourfold by the year 2050. There were approx. 877,000 heavy-duty trucks operating in India in FY24, out of which only ~270 trucks were LNG-based. While this segment is expected to grow at 8% to 10% CAGR in the next 10 years, the LNG fleet will form a larger share of this market on the back of increased adoption and policy support.

GoI targets to convert 33% of its long-distance, heavy-duty trucks to liquefied natural gas (LNG) within the next few years, a segment that is expected to continue its strong growth, owing to steady momentum in the end-use sectors. Considering the current momentum, we should be able to achieve this target in the next 15 to 20 years.

The LNG fleet is expected to reach ~5% penetration in new additions, totaling ~64,000 trucks by FY30E.

Major carbon emission intensive sectors in India like cement, steel, FMCG and metal have started to introduce green fleets to reduce Scope 3 emissions. This will further push demand for alternate fuel vehicles, including LNG.

Figure 13: LNG trucks sales (No. of trucks)



Market size	FY23	FY24	FY27E	FY30E	FY35E
(US$ million)	3	24	1,181	5,669	26,100

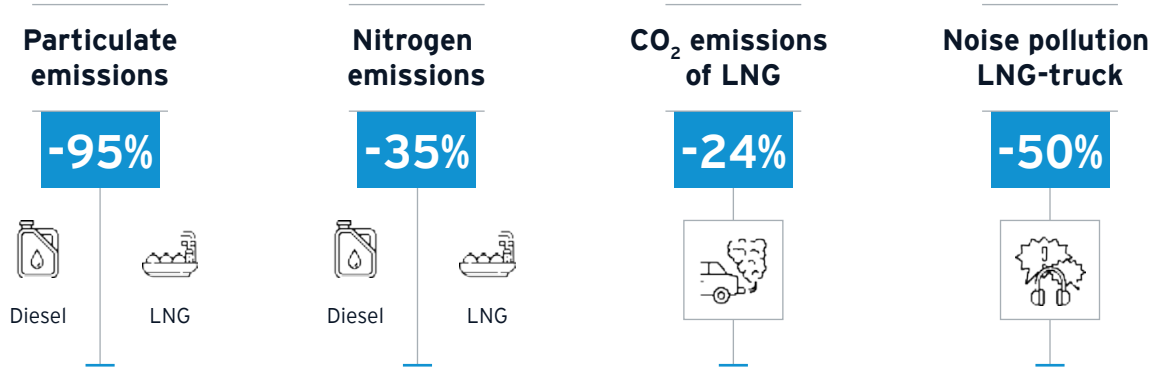
Notes and assumptions: Historical fleet details have been sourced from the Vaahan portal. Growth for HD fleet till FY35E estimated using end-use sector growth.
Historical fleet details have been sourced from the Vaahan portal. Growth for HD fleet till FY35E estimated using end-use sector growth.

Source: EYP Analysis

LNG trucks are more carbon efficient, having ~24% lower emissions compared to diesel trucks driven by higher combustion efficiencies and lower carbon intensity

Long-haul trucking accounts for approximately 35% to 40% of the overall emissions from road transport. To curb vehicular emissions within the transportation industry, it is essential to encourage the use of LNG in heavy-duty vehicles, as LNG produces 24% fewer emissions than diesel[14]. LNG has lower wall-to-tank emissions driven by lower carbon-intensive processing and more efficient energy production processes. Pollution-intensive end-use sectors such as cement, steel and metals are looking at onboarding LNG trucks to benefit from lower emissions and achieve sustainability targets. There are currently 500 LNG trucks in operation, and customers are primarily shifting to avail emission reduction benefits. Customers in key segments have built a strong pipeline of LNG fleet after realizing benefits from transition in trial stages.

Figure 14: Emissions of LNG compared to diesel



Source: Secondar research

LNG trucks would also help reduce the nation's import bills

Owing to better unit economics of LNG trucks as opposed to diesel trucks, the overall spending on fuel will come down due to lower prices of LNG compared to diesel. This will have further benefits to the exchequer, as overall spending on imports will go down.

Based on NITI Aayog estimates, transitioning from diesel to LNG in the base case scenario, where 10% of new diesel vehicles are converted to LNG by 2032, could result in a cumulative reduction of US$1.5 billion (in nominal terms) in oil import expenditure by 2032.

Total Cost of Ownership (TCO) is lower for LNG trucks than diesel trucks, even with higher upfront costs due to lower fuel and maintenance costs

Typically, the total cost of an LNG truck, encompassing the trailer, insurance, Regional Transport Office (RTO) fees, road tax and miscellaneous charges, is approximately INR85 lakhs. A 50-ton LNG vehicle, compared to a diesel-powered truck with a calorific value of 10,900 Kcal/kg, benefits from a higher calorific value of 12,950 Kcal/kg, allowing it to travel further on a fuel tank of equivalent capacity. The actual range can vary based on the terrain and the weight of the cargo. Due to LNG's higher fuel efficiency, which is about 20% greater than that of diesel, the operational costs are lower.

Table 04: Key characteristics of 4W heavy truck use case (Gross vehicle weight >50 ton)

Key characteristics	LNG Trucks	Diesel trucks
Vehicle price (ex-showroom)	72 lakhs	55 lakhs
Fuel cost	INR61/kg	INR88/liter
CAPEX per km	INR4	INR3
OPEX per km	INR26	INR38
TCO per km	**INR30**	**INR41**

Notes and assumptions: Cost of trucks as per market rates (as of 2024) of Diesel (Tata Signa 5530) and LNG trucks (Blue Energy 5528) .

Source: Secondary research; EYP analysis

Fleet operators would enjoy lower cost of ownership from LNG trucks than diesel trucks. For the end user, the pricing of logistics for LNG fleets is similar to diesel fleets, which are still preferred due to the emissions reduction benefit.

Marquee customers across key sectors such as cement, steel, FMCG and metal are ramping up fleet conversion to LNG

Sustainability focused market leaders in these key sectors are looking at options to reduce their emissions in logistics. While EV adoption has started in smaller fleet size, these companies have realized the benefits of LNG trucks for longer point-to-point distances.

Table 05: LNG and EV fleet addition plans for leading organizations

Key companies	ESG score 2024	Fleet targets
Cement (1)	73	Company aims to reach net zero emissions by 2050. It has recently announced plans to have 1000 LNG trucks and 500 EV trucks in their fleet in the next five years.
Steel (1)	69	Company has introduced green vehicles like LNG and electric trucks and aims to reach carbon neutrality by 2045.
FMCG (1)	81	Company aims to achieve net zero emissions by 2045, and it has started deploying carbon efficient vehicles for logistics.
Metal (1)	76	With a fleet of ~100 LNG trucks along with electric trucks, the company aims to reduce emissions by 25% by 2030 and reach net zero emissions by 2050.

Note: (1) represents one company each from the selected industry group.

Source: S&P Capital IQ, Secondary research; EYP analysis (based on annual report and primary discussions)

GOI and other stakeholders are working to increase the adoption of LNG fleet in heavy-duty trucking

- The LNG draft policy proposes allocating 0.5 MMSCMD of gas for the next three years to LNG trucking, which will stabilize LNG prices. This can support 50,000 trucks.
- The policy aims to set up 1,000 LNG fueling stations to ensure the availability of LNG for long-haul, heavy-duty trucks and other vehicles, covering all major highways, industrial, and commercial centers.
- Oil and gas marketing companies (OMCs) are required to set up 49 LNG stations in the initial phase of the draft policy. This number may increase based on availability, usage, and the growth of the LNG market.
- Small-scale liquefaction plants are being developed in off-grid areas. These plants will convert biogas into bio-LNG, offering an additional source of clean energy for the transport sector.
- GOI aims to establish a uniform LNG price nationwide. Currently, due to different state taxes, the cost of LNG varies across India.
- NITI Aayog has proposed reducing the VAT on LNG sales for heavy-duty vehicles from 10% to 5% to lower operational costs and encourage adoption.

There are proposals to lower taxes and remove tolls for LNG trucks. Some states could also provide incentives for truck acquisitions and establish a fund to subsidize LNG in the transportation sector, making it up to 20% less expensive than diesel.[15]

Large NOCs are planning to create 1,700 stations in the next 10 years

A state-run oil company is investing about US$77 million to set up LNG fuel stations on the major national highways, along the Golden Quadrilateral and mining hubs. The company aims to garner more than 50% market share by 2030.

- All the major companies are targeting national highways and the Golden Quadrilateral route for setting up LNG retail outlets.
- Two major oil and gas companies have partnered with a large Abu Dhabi oil company to deliver LNG every year.
- A leading Indian JV O&G company has announced plans to setup 1,300 LNG stations
- International oil companies expect the market to be worth multi-million dollars within the next decade, extending the need for overall infrastructure for LNG, from downstream operations to LNG import and the availability of LNG-powered trucks.
- An international oil and gas company, will set up 100 LNG stations in India, mainly focusing on markets outside major cities.
- International oil companies expect the market to grow exponentially within the next decade, extending the need for an overall infrastructure for LNG, from downstream operations to LNG import and the availability of LNG-powered trucks.

How an Indian company is driving the adoption of LNG-powered ecosystem

One of the leading Indian logistics players has laid out plans to deploy more than 5,000 LNG trucks by FY25, with an investment of US$600 million.

The company is utilizing its targeted marketing to expand its operations. Its client base includes companies from multiple industries, especially hard to abate industries such as cement and steel.

Leading companies in these industries have established clear sustainability targets for their logistics fleets, and incorporating LNG trucks aligns seamlessly with their environmental objectives.

It has also partnered with India's leading e-commerce player to support its sustainable supply chain operations, by deploying 25 LNG fueled trucks.

In addition to trucks, the company has also opened its first privately-owned LNG retail outlet in Chennai. Building on the Public-Private Partnership (PPP) model, it has tied up with multiple state-run oil companies to source LNG. Partnerships form a key differentiator for the company's growth plans. It has formed collaborations with technology companies to continuously develop new solutions to enhance fuel efficiency. It has also partnered with financial institutions to grow its LNG truck fleet expansion plans.

China achieved 15% adoption in LNG trucks, driven by favorable policies in the form of purchase subsidies, expansion of LNG refueling infrastructure and a diesel ban on a few routes.

China added ~10,000 LNG heavy-duty trucks in 2024, accounting for ~15% of the fleet added in that year. Its penetration is significantly higher than developed regions, such as EU, where it is only 2%.

Table 06: Comparative scenario of LNG trucks' penetration

Geography	LNG Trucks (2024)	% penetration (2024)
China	985,000	15.0%
Europe	9,549	1.9%
India	234	0.1%

Source: Secondary research

China was able to ramp up its LNG truck penetration from 3% in 2010 to 15% in 2024, owing to strong policy support and subsidies for scrapping older vehicles and purchasing an LNG fleet.

Subsidies

- China's new initiative offers a 25,000-yuan subsidy for citizens who scrap older, high-emission vehicles and purchase new, eco-friendly models
- As of October 24, the Ministry of Commerce's automotive trade-in platform received over 1.27 million subsidy applications, generating more than 160 billion yuan in new vehicle sales, with 60% of the applications accounting for new-energy vehicles.

Infrastructure

- The plan targets 10 million NGVs to reduce urban air pollution and oil dependence. It includes both CNG vehicles for public transport and taxis and LNG vehicles for heavy-duty use. Additionally, it proposes building 12,000 natural gas refueling stations nationwide.
- By 2020, China had already constructed 9,000 refueling stations and has over 7.3 million NGV vehicles on the road.

Diesel ban

- The Chinese government ordered a restriction on diesel-powered HDVs in the Beijing-Tianjin-Hebei region, where pollution from transport and heavy industry was causing dangerous smog levels.
- To promote LNG adoption, the government exempted it from excise taxes, lowering costs for vehicle operators and encouraging LNG infrastructure and fuel use in logistics and transport.

Europe launched LNG Blue Corridor in 2014 to boost LNG fleet operations. The project aimed to make LNG a viable alternative to diesel for medium and long-distance transport. It involves 27 partners from 11 NGVA Europe member countries. By April 2018, the project met its initial targets with 140 LNG trucks covering over 31.5 million kms with the infrastructure growing from 40 stations in 2014 to about 130 in early 2018.

India, which also suffers from severe pollution caused by heavy trucks, should target to replicate Chinese model by implementing policies towards subsidizing LNG truck procurement and LNG refueling infrastructure. This will encourage LNG truck usage by end-users, who in turn would achieve emission reductions and be on track to meet sustainability targets.

Table 07: LNG policies across select countries

#	Incentives	China	Italy	Spain	Netherlands	Germany
1	Subsidy on purchase of new LNG HDV?	✓	✓	✓	✓	✓
2	Monetary benefit for scrapping old diesel HDV	✓				
3	Lower tax on LNG vs Diesel	✓	✓		✓	✓
4	Toll free exemption for LNG HDV					✓
5	Procurement policy to promote LNG HDV		✓			
6	Ban on diesel HDV in select regions, where LNG HDV allowed	✓		✓	✓	
7	Fuel efficiency and/or emission targets for HDVs	✓	✓	✓	✓	✓
8	National targets on LNG HDVs and associated infrastructure	✓	✓	✓	✓	

Source: NITI Aayog, Secondary research

LNG fleet operators are targeting returns in the range of 20% to 25%, and key levers being truck utilization, procurement costs and refueling efficiency

LNG trucks benefit both fleet owners and trade, as owners gain from better economics, while trade benefits from lower emissions. Some fleet operators are integrated vertically across the value chain to drive customer adoption and enjoy lower operating costs.

There are limited OEMs manufacturing LNG vehicles in the country, so fleet operators need to form strategic partnerships with these OEMs

The green logistics market currently faces challenges due to a limited number of Original Equipment Manufacturers (OEMs), with only a few active players dominating the sector and production capacity constraints.

Table 08: Overview of number of LNG trucks in India

OEM	Player 1	Player 2	Player 3	Player 4
Capacity per year	10,000	1,000-1,500	500-600	500

Source: Secondary research

- Despite this, there are clear indications of expansion plans by major OEMs as demand for sustainable logistics solutions grows in end-use sectors like cement, steel and metals, where emissions are high and sustainability is a priority.
- These OEMs are gradually expanding their LNG heavy-duty trucks offerings to meet stricter environmental regulations and growing customer preferences for greener supply chains.
- Strategic tie-ups with OEMs will be crucial for fleet operators looking to adopt green technologies and scale their operations.
- In one notable case, a fleet operator successfully leveraged its group company for procurement. This ensured a streamlined supply of vehicles and equipment at competitive costs, along with priority in supply. This example highlights how integrated business models or strong partnerships with OEMs can provide a competitive advantage in this emerging market.

Future developments will likely focus on scaling production and expanding the network of service providers, which will further enable fleet operators to transition toward sustainable logistics solutions.

If RBI includes green vehicles under priority sector lending, the interest rates could come down

India's push towards financing green vehicles is gaining momentum with proposals like including electric vehicles (EVs) under the RBI's priority sector lending guidelines. If implemented, this move is expected to reduce financing costs and make loans more accessible, thereby accelerating EV adoption. Such initiatives aim to make sustainable transportation options more affordable and widespread, aligning with India's climate goals.

Currently, LNG fleet operators rely on loans from private financiers typically at interest rates ranging between 10% and 12%. While this financing supports LNG vehicle growth, expanding affordable credit for green vehicles, including EVs, would significantly enhance adoption rates.

Lower interest rates through priority sector lending or government-backed schemes would not only incentivize fleet operators to transition to cleaner alternatives but also reduce operational costs, promoting a larger shift to sustainable mobility solutions. This step is vital for achieving broader green logistics goals and reducing dependence on fossil fuels.

Refueling network will determine routes for LNG fleet operators. Current plans are to capture golden quadrilateral and major national highways

Charging and refueling infrastructure is critical for the adoption and operation of electric/green fleets. Leading oil and gas players have announced to set up more than 1,700 LNG refueling stations in the long term.

Table 9: Overview of LNG retail outlets (ROs)

NOC	Player 1	Player 2	Player 3	Player 4
# of ROs	6	3	2	1

Source: Secondary research

- The location and availability of charging stations (Retail Outlets - ROs) will determine the routes that a fleet operator can service.
- Without reliable access to strategically placed charging/ refueling points, operations may face disruptions or inefficiencies.
- Fleet operators with direct tie-ups with National Oil Companies (NOCs) or charging infrastructure providers can significantly enhance operational efficiency.
- These partnerships can ensure priority access, customized solutions, and potentially lower costs for charging/refueling.
- Fleet operators who proactively align with charging network providers or build in-house infrastructure will gain a competitive edge in terms of flexibility, cost control, and reliability in meeting customer demands.

LNG trucks have an average payback period of five years, compared to seven years for diesel trucks

Fleet operators are targeting an Internal rate of return **IRR of 20% to 25%** based on typical truck operational parameters for LNG trucking operations. The similar range for diesel trucks is expected to be much lower as the operational costs are higher.

Utilization will significantly impact the overall returns for fleet operators, necessitating the roll-out of refueling outlets along major road networks to minimize unpaid kilometers.

Table 10: Multiple IRR scenario basis kms run

Run kms	5,000-6,000	6,000-7,500	>7,500
IRR	5-10%	20-25%	>25%

Note: The IRR of the truck may vary based on run kilometers, as scale benefits accrue to operations.

Source: Secondary research, EYP Analysis

Higher utilization of a fleet (measured in run kms) directly improves the IRR driven by fixed costs, such as depreciation, loan interest and insurance being spread over more kilometers, reducing the cost per km and improving profitability.

LNG fleet can transform point-to-point long-haul transportation in India and contribute directly toward emissions reduction, which was already seen in China. Chinese government had provided subsidies and rebates to allow fleet owners to shift, and similar policy support from the Indian government can help in accelerating LNG adoption.

2.IV Green warehouses

The Indian green warehousing market is projected to grow at a CAGR of 12.1% from 2024 to 2032, reaching a revenue of US$25.2 million by 2032.[16]

Businesses are moving towards eco-friendly practices such as energy-efficient lighting, renewable energy sources, and sustainable building materials for warehouses[17].

The Indian warehousing market was valued at US$14.2 billion in 2021, and is expected to reach US$33.9 billion, growing at a CAGR of 15.6% between 2022-27[18]. End-use sectors are demanding for grade-A warehouses for efficiency storage and handling of their products. Further, higher velocity of logistics warrants further development of warehouses.

Key features of a green warehouse include energy efficient systems such as LED lighting and advanced HVAC, use of renewable energy sources, and water harvesting measures. Apart from the operations, green warehouses are even designed and constructed using eco-friendly material and implement waste management strategies that promote recycling and reduce waste generation.

Certified green buildings in India attract a 7% to 10% higher rental premium compared to non-certified buildings.[19] The combination of significant long-term energy savings and increased demand makes green certifications highly valuable for property owners. Similarly, for green warehouses, such certifications can enhance rental income, drive sustainability, and boost their appeal in the market, making it an attractive investment opportunity for private players.

As India seeks to double its logistics market, it is focusing on balancing growing demand with strict environmental standards, leading to collaborative efforts from the Government of India (GOI) and industry to advance green logistics, invest in eco-friendly technologies, and adopt sustainable practices.

A green warehouse helps achieve operational cost savings of 15% to 25%, compared to a traditional warehouse of a similar capacity

Green warehouses have been found to consume around 42% lesser energy and contribute to carbon reduction, biodiversity preservation and better waste management. Currently, the proportion of green-certified warehouses is slowly increasing with the recognition of their benefits. The global push and growing awareness among foreign investors about rising cost of resources such as energy, water and materials is expected to drive the demand for sustainable warehouses.

Figure 15: Environmental savings from a green warehouse [20]

39%-42%
Savings in total energy consumption (kWh/month)

28%-30%
Savings in water consumption (litres/person/day)

32%-35%
Reduction in total embodied energy (MJ/Sqm)

2.5-4 Years
Average payback period for return on investment

Source: Secondary research, JLL

Warehouse developers and occupiers are enjoying operational cost savings across energy and water consumption, which adds to the benefits of lower emissions.

Table 11: Overview of environmental savings of a green warehouse

Category	Green Warehouse Practices	Savings Potential
Energy costs	Solar panels, LED lighting, HVAC	20%-30% savings on electricity bills
Water sosts	Rainwater Harvesting, efficient fixtures	30%-40% on water bills
Waste management	Recycling, composting, reduced landfill costs	10%-20% in waste disposal expenses
Operational efficiency	Automated Systems, IoT based energy monitoring	10%-15% in productivity related expenses
Maintenance costs	Durable, eco-friendly materials, smart monitoring	10%-20% reduction in maintenance costs

Source: EY-Parthenon Analysis

Indian warehousing sector is increasingly adopting sustainable practices to curtail carbon emissions[21]

By the end of 2023, the total warehousing stock in major Indian cities, covering grade A and B facilities, expanded to 371 million square feet, showing a significant rise compared to the previous year. However, warehouses significantly contribute to carbon emissions, accounting for about 11% of emissions from logistics activities, including transportation, which accounts for a larger share.

GOI push through incentive such as tax deductions and subsidies are playing a key role in expanding the green warehousing sector in India

The Government of India (GOI) has been actively promoting renewable energy through various incentives and policies such as the National Solar Mission and by providing subsidies, tax breaks and grants for businesses investing in solar power. The pivot to renewable energy in warehousing is also driven by cost savings and the corporate responsibility initiatives of the companies.[22]

The GOI is also promoting green logistics by offering various incentives and schemes to attract private sector investments, including:

- **National Logistics Policy (NLP):** The NLP emphasizes the need for sustainable logistics practices, including adoption of green technologies in warehousing. This policy incentivizes warehouses to adopt net zero practices, which include energy efficient designs and technologies that minimize environmental impact.
- **Tax deductions on green projects:** GOI provides tax deductions on loans for green buildings along with subsidies for solar installations, and reduction in import duties for solar panels.[23]
- **Subsidies on rural godown construction:** The Ministry of Agriculture's Gramin Bhandaran Yojana offers up to 25% subsidy on capital costs for construction and renovation of rural godowns.[24]

State government initiatives are also instrumental in accelerating the push towards green logistics and warehousing:

- **Tamil Nadu** Industrial Policy (2021) provides subsidies of up to 25%, capped at US$0.1 million, for establishing infrastructure in industrial sheds and warehouses focused on sustainable energy use, waste recycling, and water conservation.[25]
- **Uttar Pradesh's** Warehousing and Logistics Policy 2022 promotes smart warehousing, solar energy use amongst others for sustainable logistics. It encourages private investments in green measures and allows open access for captive solar power generation in the logistics industry through subsidies in stamp duty, development charges and other capital subsidies.[26]
- **Haryana** is advancing green warehousing through tax breaks and subsidies, especially in regions such as Sonipat, by focusing on sustainable energy, waste management, and eco-friendly practices to improve the environmental performance of warehouses.[27]

Green certifications from credit rating authorities are providing a framework to warehouse developers

Certification agencies such as the Indian Green Building Council (IGBC), Leadership in Energy and Environmental Design (LEED), and IFC Excellence in Design for Greater Efficiencies (EDGE) have introduced dedicated programs for sustainable warehouses. These certifications encourage the adoption of sustainable practices, leading to significant reductions in energy and water consumption, lower greenhouse gas emissions and enhanced storage space utilization.[28]

The IGBC has developed a comprehensive rating system specifically for logistics parks and warehouses. This system evaluates projects based on their green design, construction, and operational practices, and awards certifications at various levels: Platinum, Gold, Silver, Bronze and Basic. The rating system evaluates logistics parks and warehouses based on the following key criteria:[29]

Figure 16: Key criteria for IGBC rating system for logistics park and warehouse

Source: Secondary research

Credits are provided according to the number and type of green initiatives adopted. The ratings are further decided using the following threshold criteria:[30]

Table 12: IGBC rating system threshold criteria for warehouses

Certification level	Logistics Parks				Recognition
	Owner occupied		Tenant occupied		
Certified	40-49	40-49	36-44	36-44	Best practices
Silver	50-59	50-59	45-53	45-53	Outstanding performance
Gold	60-74	60-74	54-62	54-62	National excellence
Platinum	75-100	75-100	63-90	63-90	Global leadership

Source: Indian Green Building Council (IGBC)

Organizations such as Small Industries Development Bank of India (SIDBI) provide loans at concessional interest rates to micro, small and medium enterprises (MSMEs) that are adopting energy-saving technologies. To avail these benefits, developers can present certifications from agencies such as the Indian Green Building Council (IGBC) and Excellence in Design for Greater Efficiencies (EDGE) for their warehouse.

Luhari Logistics Park: India's first logistics park to earn green platinum certification under the IGBC's rating system for logistics parks and warehouses.[31]

A developer and manager of grade A industrial and logistics real estate has been awarded platinum certification by the Indian Green Building Council (IGBC) for its logistics parks at Luhari I and II in Haryana owing to the following green warehousing practices:

- Gaining EDGE certification for 45% and advanced EDGE certification for 55% of its buildings
- Solar rooftop panels
- Use of sustainable material such as fly ash and crushed sand
- Built with precast concrete waffle walls
- Zero discharge STP plants, 100% utilization of treated wastewater for landscaping and flushing
- Organic waste converters processing 100% of gardening waste
- EV charging stations
- More than 95% of area are daylit
- Miyawaki plantations (using native species)

The warehouses have achieved more than 40% savings on energy, water and embodied energy in materials.

Shristi Warehouse secured the esteemed EDGE certification, setting a benchmark for resource-efficient infrastructure and contributing to significant energy savings.[32]

A key player in logistics and warehousing in Delhi has made significant milestone in sustainability by achieving EDGE certification for its warehouse by undertaking following green practices:

- Insulated exterior walls, natural ventilation, high-performance glass, and efficient lighting
- Smart meters for energy and power factor correction
- Water-efficient faucets, toilets, and urinals
- Aluminum-clad sandwich panels and plasterboard-insulated timber stud walls to reduce embodied energy and carbon footprint

The warehouse achieved 30% energy savings, 54% water savings, and 53% less embodied energy in materials. Annually, this translates to saving 295 MWh of energy, 15,524 m³ of water, and reducing 141 tons of CO_2 emissions.

Private players are gradually driving growth of the Indian sustainable warehousing sector by investing in eco-friendly infrastructure and green technologies

In Q2FY24, India's real estate sector received inflows of US$2.5 billion, registering year-on-year increase of 20%. The industrial and warehousing sector led this surge, receiving 60% of the total investments. Foreign investments remained strong, comprising 81% of total inflows, primarily driven by investors from the US and the UAE. Investment surge in the sector is driven by increasing demand for grade A facilities and evolving supply chain models.[33]

Major investments and initiatives by private and institutional players in the Indian sustainable warehousing market include the following:

- In 2024, a fund management company has announced an investment of US$236 million (spanning over next five years) towards building logistics and industrial parks in Tamil Nadu. The company's aim is to develop sustainable infrastructure and create job opportunities in the state.[34]
- In 2024, a logistics company announced plans to invest around US$26 million to establish a new logistics facility in Pithampur, Madhya Pradesh. It intends to include technologically advanced, and eco-friendly grade A warehousing options to sectors such as e-commerce, retail, and FMCG, creating over 1000 new jobs.[35]
- In 2024, a sustainable logistics company unveiled its plan to invest around US$54 million to establish its inaugural industrial and logistics park in south India. The planned park will be located in Hosur, Tamil Nadu, covering 50 acres and offering a development capacity of 1.25 million square feet.[36]
- In 2022, a leading global logistics player announced a US$540 million investment in India over the next five years to expand its warehouse capacity, workforce, and sustainability initiatives. This will include owning and operating large multi-client sites, adding 12 million square feet of warehouse space. All new sites will feature green technologies such as solar panels, rainwater harvesting, LED lighting, and smart meters.[37]

Companies in India are increasingly adopting green warehouses, either owned or 3PL owned, to reduce their Scope 3 emissions, commonly known as value chain emissions

We have covered a few examples below:[38]

- A leading Indian logistics solution provider has more than 3.3 million square feet of carbon-neutral warehousing space across India. Its warehousing locations boasts of multiple sustainable practices, including using 100% solar and battery stored energy, waste collection drives, observing green hour every month by switching off non-essential lights, EV charging infrastructure and forest plantation.
  - The company aims to become carbon neutral by 2040, and this is a step towards its sustainability journey.
- To curb its Scope 3 emissions, another major Indian mobility company has tied-up with a warehouse provider, which has recently launched its first green warehouse. The warehouse utilizes solar power, employs smart material handling methods, uses CNG-powered vehicles for last mile deliveries, and features PU flooring.
- Another leading multinational company in India, dealing in chemicals, has opened a new green cold storage warehouse in Haryana. The warehouse is EDGE certified and has insulated walls to enhance energy efficiency, solar panels and water harvesting systems, among other things.

Companies worldwide are adopting innovative construction methods and advanced heating and lighting systems to enhance energy efficiency in green warehousing. They are using automatic handling equipment in dark warehouses, operating in lights-out mode to minimize carbon emissions. For instance, a Danish logistics company and a leading port authority in the Middle East are collaborating to develop a multi-modal logistics park entirely powered by solar energy. The facility's design allows for higher storage density, automated pallet-in-out systems, a product-to-man pick-and-pack approach, and streamlined workflows. These enhancements boost productivity by around 50% and significantly reduce emissions.[39]

Since India's green warehousing segment is gradually developing, such approaches can serve as a model for Indian companies aiming to adopt greener practices and improve efficiency.

03

Driving sustainability: Role of carbon credits

Carbon markets are witnessing strong growth, with a record US$104 billion in revenue in 2023 and notable progress in carbon pricing globally

As global efforts to combat climate change gain unprecedented momentum, carbon markets are emerging as one of the most dynamic and rapidly expanding sectors in the green economy. According to the World Bank's annual "State and Trends of Carbon Pricing 2024" report, carbon pricing revenue reached a record US$104 billion. The report highlights significant progress in carbon pricing implementation among large middle-income countries, including Brazil, India, Chile, Colombia and Turkey. These nations are making notable strides in integrating carbon pricing mechanisms to address climate change.

Governments around the world are leveraging carbon crediting frameworks to attract additional financing through voluntary carbon markets and to facilitate engagement in international compliance markets. There are now 75 carbon pricing instruments in operation worldwide.

Government's push to enhance India's energy efficiency and reduce carbon emissions

The Government of India (GOI) established the carbon credit market in India through the Energy Conservation (Amendment) Bill, 2022. Under this framework, entities can register as "Registered Entities" to participate in carbon credit trading, with certificates issued by the central government or its authorized agencies. The bill also allows voluntary carbon credit purchases by individuals or organizations.

A key provision of the amendment is the fungibility of unsold Renewable Energy Certificates (RECs) and Energy Savings Certificates (ESCerts), allowing them to be converted into carbon credits. Additionally, the export of carbon credits from India is now banned from the policy of prioritizing domestic sustainability goals. However, trading would be allowed with specific nations such as Japan, who would buy green hydrogen from India. The Bureau of Energy Efficiency (BEE) will provide technical guidelines for the operationalization of the carbon credit market, aiming to streamline the trading system and enhance the country's emissions reduction efforts.

Several Indian corporates have committed to becoming net zero by 2050

As part of its Nationally determined contributions (NDCs), India aims to decrease its carbon intensity by 45% and establish a 2.5-3 GtCO2e carbon sink via increased forest cover by 2030. Further, GoI though its renewable energy initiatives is targeting to generate c. 50% of electricity via non-fossil fuel-based resources.

Around 30 Indian companies have also submitted commitment to Science-Based Targets initiative (SBTi) with regards to achieving net zero emissions by 2050 or sooner. SBTi is a collaborative initiative involving the CDP, the United Nations Global Compact, the World Resources Institute and the Worldwide Fund for Nature. It provides target setting methods and guidance to companies on the environment sustainability front. Major enterprises have emerged as the front-runners via adopting renewable energy for their requirements, by using energy efficient equipment and focusing on carbon capture technologies. We believe the players involved in green mobility and logistics would have a huge role to play in carbon credits trading.

Multiple avenues available for the green mobility players to monetize the carbon credits

- **Voluntary emissions reduction (VER):** A carbon offset that is exchanged in the over the counter or voluntary market for credits. It is typically used by businesses seeking to offset their carbon emissions.
  - Multiple registries available and newer options (Universal Carbon Registry, Carbon Recycling International) would also be available as market expands.
- **International Renewable Energy Certificate (I-REC):** Standard provides exchangeable Energy Attribute Certificate (EAC) that can be used for a variety of (voluntary) requirements (multiple private sector agencies are involved, e.g., APX).
- **Certified emissions reduction (CER):** Emission units (or credits) created through a regulatory framework with the purpose of offsetting a project's emissions. It is typically used by developed countries (recognized as Annex 1 under the Kyoto Protocol) to reach their emission target.
- **Indian Carbon Market (ICM):** GOI has released a draft of the Carbon Credit Trading Scheme (CCTS), which establishes the institutional framework and mechanisms for the functioning of the Indian Carbon Market. The draft includes a structure for both voluntary trading and compliance market. The proposed plan will help India to support the achievement of the Indian Nationally Determined Contribution (NDC) under the Paris Agreement.

As of June 2023, India had 860 registered projects with Verra and Gold Standard, the world's two leading carbon crediting programs that certify projects to receive credits. These programs account for nearly 90% of global carbon credits, with approximately 298 million credits issued to Indian entities. By May 2023, 163 million credits had been sold to other companies. Additionally, several renewable energy projects in India are registered with the Global Carbon Council (GCC), the Middle East & North Africa (MENA) region's first voluntary carbon-offsetting program, initiated by the Gulf Organization for Research and Development (GORD). GCC operates with standards similar to the UN-level CDM market and registers projects commissioned from 2016 onward. The Indian market has also seen the rise of third-party carbon credit consultants that simplify the processes of registration, trading, and monetization of carbon credits. Key players in green mobility and logistics have a significant opportunity to participate in carbon trading.

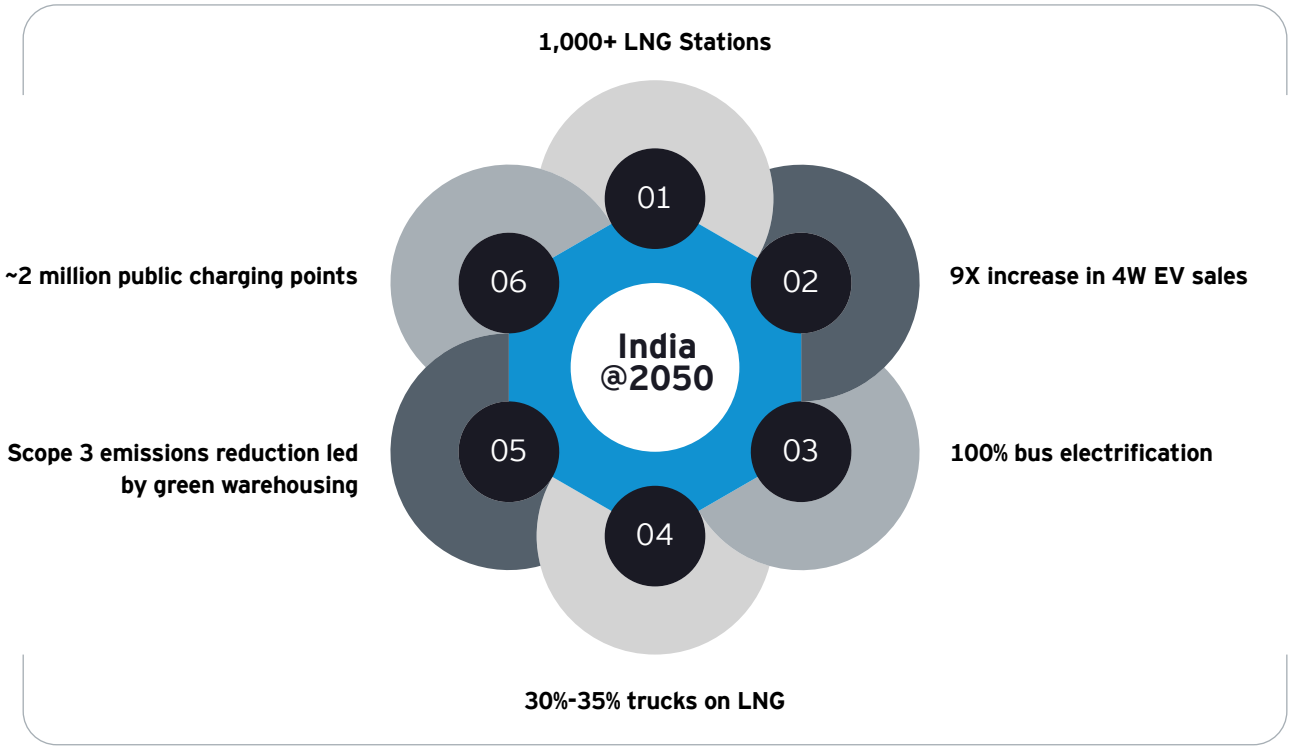
04

Desired outcomes for India by 2047 from rom green mobility and sustainable logistics

India's net zero target for 2070 is supported by specific interim goals and growing private sector participation. Some interim goals are targeted towards 2030, while others are targeted towards completion by 2050. To achieve the net zero target by 2070, it is crucial to address the emissions associated with freight movement. As per the current estimates, emissions from freight movement stood at 6.6 MtCO2 in 2020. To align with the net zero target, these emissions need to be reduced to 5.1 MtCO2 by 2030, which equates to a reduction of approximately 30% from the 2020 levels.

This reduction in emissions from mobility and logistics is a critical step towards the broader goal of achieving net zero emissions. The graphic below highlights the vision of where India will be by 2047.[40]

Figure 17: Our vision of India@2050



01 Wide network of LNG stations will support long haul, heavy-duty trucks and other vehicles, thereby reducing reliance on diesel and enable emission reduction.

02 The penetration of 2Ws and 3Ws are expected to reach 90% of the total sales in respective categories.

03 The adoption of e-buses in private intercity transport can significantly reduce GHG emissions. Achieving 100% e-bus penetration hinges on greater private sector involvement.

04 OEMs are expanding their EV and LNG truck offerings to meet environmental targets: 75% of new passenger vehicles to be EVs by 2050 and 33% of heavy-duty trucks to be LNG-powered by 2030

05 By 2047, we expect every sq. ft. of grade-A warehouses built to implement sustainable initiatives and aid to the country's goals of new zero.

06 Polluting sectors to shift their heavy-duty long-haul fleet to LNG and achieve sustainability targets. Further, technological advancements may also break into medium-duty short-hauls and bring TCO parity.

Source: Secondary research, EYP Analysis

Investments in manufacturing

India's rapidly growing EV industry has an investment potential of over US$200 billion combined in electric vehicles, charging infrastructure, and batteries by 2030.[41]

- The vehicle manufacturing sector alone requires US$178 billion
- Battery manufacturing needs US$12.3 billion (for 100% indigenization)
- US$2.9 billion is needed for charging infrastructure

Growth in EVs would present opportunities in parallel industries, providing avenues for investments in the whole supply chain. As the demand for mobility increases, energy requirements are set to rise four times by 2030, further supporting new investment avenues – alternative fuels and green logistics supply chain.

Similarly, other themes such as LNG fleet will see global players setting manufacturing units and LNG stations in the country to support the initiative.

Organized platforms to replace fragmented single ownership trucks to make it efficient

In India, more than 70% of the trucks are managed by single fleet owners, which demonstrates the extent of an unorganized share in this market. As organized players continue to scale up, the share of unorganized is expected to come down and bring several benefits to the trade. Some of them are listed below:

- Reduction of empty runs: Platforms match return loads to trucks after delivery, reducing the number of empty trips.
- Real-time visibility and tracking: GPS-enabled tracking systems and telematics to provide real-time updates on truck conditions and cargo status.
- Compliances: Organized platforms implement standardized processes for vehicle maintenance, driver training, and documentation.
- Driver welfare: Organized platforms offer better working conditions, such as assured payments, health insurance, and route assistance.

Further, these organized fleet operators are the ones who have taken the step towards green mobility and continue to add EVs and LNG vehicles to their fleet. It is safe to say that organized platforms would drive the entire green mobility initiative, and they are growing in scale with every passing year.

In conclusion, the mobility and logistics sector in India is facilitating the move towards net zero by 2050 through the adoption of green vehicles, the development of infrastructure for alternative fuels like LNG, the electrification of public transport and promoting the development of green warehouses. These efforts are part of a larger strategy to reduce fossil fuel dependence and lower carbon emissions in the transportation sector.

The government's vision and efforts are well aligned towards fast-tracking India's path towards sustainable mobility and logistics. We expect further regulatory push, enabling policies and incentives to attract the private sector and help them make successful investments and realize the country's goals.

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