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NITI Aayog

Financing Dialogue for Decarbonizing Transport

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Address:
NDC Transport Initiative for Asia (NDC -TIA) – India component
GIZ Office, B-5/2, Safdarjung Enclave
New Delhi – 110029, India
T +91 11 49495353 F +91 11 49495391
http://www.giz.de/india

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Executive Summary

The EV ecosystem in India is witnessing remarkable growth, driven by various factors such as increasing consumer awareness, rising fuel prices, and government incentives. As the world's third-largest automobile market and one of the fastest-growing automotive markets, India is well-positioned to capitalize on the EV revolution.

The reduction in upfront costs, increased awareness about the benefits of EVs, and continued central and state-level subsidies have fueled higher EV sales in the e-2W and e-3W segments. As a result, India's EV sales reached an impressive 4.0 million units as of April 2024, reflecting a CAGR of around 58% over the last five years.

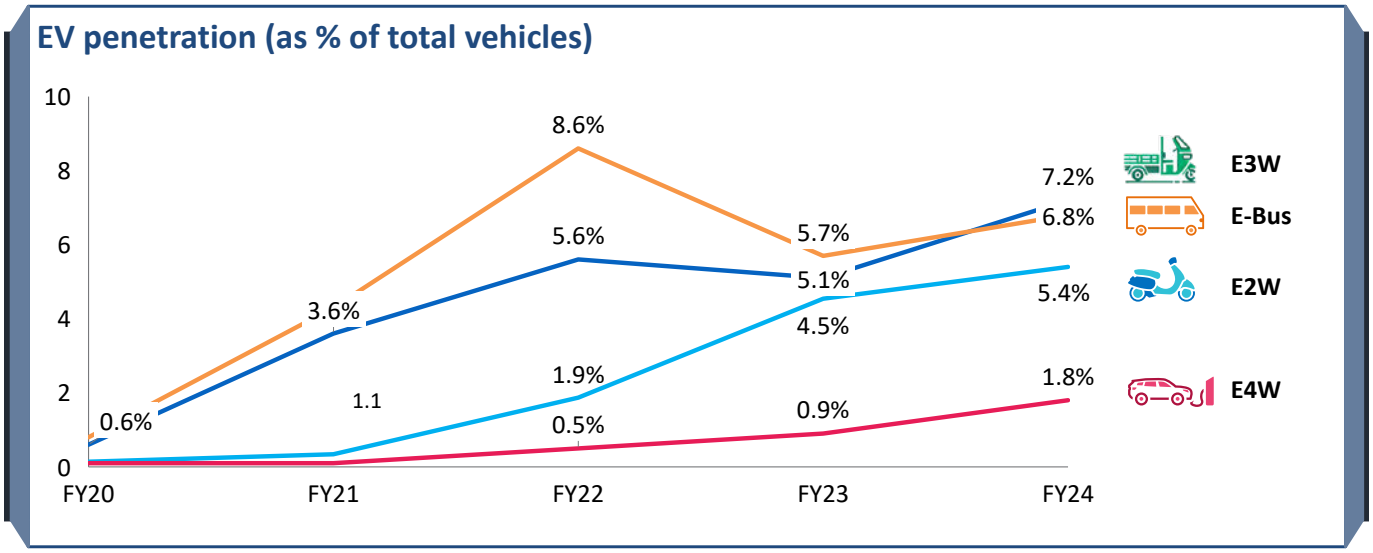


Figure 1: Historical Trend of Segment-wise EV Penetration

EV Market Size by 2030

The Indian government has taken progressive steps to accelerate EV adoption, leading to growing demand. According to NITI Aayog's projections, by 2030, the penetration of various EV categories is likely to be as follows:

- 35-40% for two-wheelers
- 9-11% for private four-wheelers
- 20-25% for shared four-wheelers
- 13-16% for buses

To achieve this, EV market is expected to grow at a CAGR of 49% from 2024-2030, with major contributions from the e2W and e3W segments. Following table shows EV stock by 2030:

	2W- Expected to increase from 22 lakh currently to 260 lakh by 2030
	3W- Expected to grow from 1.4 lakhs units currently to 12 lakhs units by 2030.
	4W- Forecasted to grow from 2 lakhs units to 25 lakhs by 2030.
	Bus- Anticipated to rise from 8,000 units currently to 0.91 lakhs by 2030
	LCV- Sales projected to surge from 14,000 units currently to 3.4 lakh by 2030

Table 1: Expected Segment-wise EV Stock by 2030

EV Market and financing size in 2030

With growing EV adoption, the EV financing market is expected to grow to INR 4.80 lakh crores by FY 2030. The market volume for EVs is projected to increase significantly across all segments, reaching a total of 3.0 crores vehicles.

	EV Penetration	EV Volume (in lakhs)	EV Market Size (in INR'000 Cr)	Financing Requirement (in INR '000 Cr)
2-W 	35-40%	260	325	122
3-W 	26-29%	12	50	43
Cars 	11-25%	25	375	225
Buses 	16-20%	0.9	99	84
LDV 	15%	3.4	51	44
Total	30%	-301	900	518

Table 2: Segment-wise EV Market and Financing Size in 2030

- The projected EV Volume in 2030 is 3 Cr. EV that reflects substantial growth anticipated across segments of the EV market.
- Indian EV market is expected to reach INR 9.0 lakh crore by 2030, with E-4W has the highest share followed by E-2W in market size.
- The total financing requirement of the Indian EV market expected to reach 518 thousand crores where E-4W will command significant size.

The financing required by 2030 underscores the crucial role of financing mechanisms in driving EV adoption. As EV penetration increases, innovative financing solutions will play a key role in making EVs more accessible for consumers, thereby accelerating the transition to sustainable mobility in India.

India's vehicle finance Industry

India's vehicle finance industry has seen significant growth recently. In the Indian vehicle finance market, 4W Passenger Vehicles (PVs) dominate with 50% of the total finance, followed closely by Commercial Vehicles (CVs) receiving 40% of the financing, while the remaining 10% is allocated to Tractors and Two-Wheelers.

Financing penetration - In the vehicle finance sector, 2Ws see a financing penetration of 35-50%. 4W PVs have a high financing penetration of 80%, indicating strong market dynamics and consumer confidence in financing. Commercial Vehicles experience an exceptionally high financing penetration of about 95% for new light, medium, and heavy-duty vehicles.

Key Stakeholders in vehicle financing - The landscape of vehicle finance in India is diverse, comprising various stakeholders categorized into banks, NBFCs, and fintech companies. Banks primarily focus on 4W passenger vehicles, while captive NBFCs are more active in 2W lending, and non-captive NBFCs play a prominent role in the commercial vehicle segments. Recently, fintech companies have also entered the market, focusing on digital lending.

Challenges in EV Financing

EVs have a reduced resale value due to the nascent ecosystem and a lack of a secondary market. Additionally, the nascent EV ecosystem increases perceived risks for financiers. All these lead to challenges in accessing finance for EVs:

- **Limited Financing Options:** Most FIs in India do not offer specialised products for EVs. FIs need collateral for EV loans in addition to the vehicle in case credit history is not available.
- **Unfavorable loan terms**: Potential buyers forced to choose loans with high interest rates, low LTV ratios, and shorter repayment periods, resulting in higher monthly

installments. The difference is more significant for e-2Ws and e-3Ws, with interest rates as high as 20 percent or more.

- **High Insurance Cost:** In addition to paying a higher upfront cost, customers also pay higher insurance premiums. EVs contain sophisticated technology such as lithium-ion batteries, also, EVs components are considerably more expensive given their advanced technology.

Risks in EV Financing

The following table provides a comprehensive overview of the current state of EV financing. Financiers face challenges such as the unestablished resale market, uncertainty of product quality and battery life, and increased customer risk.

FIs Perspective	Impact on EV Consumer
Resale Risk • Lack of an established secondary market, difficult to underwrite loans	**Lower LTV** • 10-30% lower LTV, resulting in higher initial down payment
Asset Risk • High risk of product failure, nascent ecosystem. E2W/ E3W OEMs are not yet established	**Higher interest rate** • Adding to EMI burden. Interest rate 2%-6% higher for EV depending on vehicle category
Technology Performance • Battery life not known, tenures matched to battery warranty to minimize risk	**Shorter loan tenor** • Higher EMI burden due to tenor 6-12 months shorter compared to ICE
Business Model - Utilization risk • TCO parity and cash flows depends on daily run of the vehicle	**Need of collateral** • Resulting in limited access to finance
Credit risk • E3W drivers, drivers owned fleet vhicles face challenges due to first time credit history,	**Limited access to funding** • Only 1-2 options offered, concerns over being able to service higher EMIs

Table 3: Overview of the current state of EV financing

However, these risks and lending terms exhibit variations across different vehicle segments and end use. These variations are due to differences in the application of the vehicle and the credit profile of the buyers, as well as whether the vehicle's use is personal or commercial.

E2W / E3W Segment

The reduction in upfront costs, increased awareness of fuel savings, and government subsidies have driven higher EVs sales in the E2W and E3W segments in India. The FAME scheme has been instrumental in supporting E2W adoption through upfront subsidies.

For certain use cases, such as ride-sharing, deliveries, and commuter services, total cost of ownership (TCO) parity with internal combustion engine (ICE) vehicles has been achieved due to higher vehicle utilization rates. However, financing for E2Ws and E3Ws remains a major hurdle that prevents mass adoption.

FIs are reluctant to offer favorable financing due to concerns over technology risks, market immaturity, and the absence of a strong secondary market. As a result, EV loans typically have higher interest rates, lower loan-to-value (LTV) ratios, and shorter tenures compared to loans for ICE vehicles.

Key Challenges in EV Financing

- Technology Risk: FIs lack reliable data on EV performance, including range, maintenance, and vehicle lifespan, which raises concerns about the viability of financing these vehicles
- Battery Performance Risk: The mismatch between battery and vehicle life, coupled with limited warranties and high replacement costs, makes FIs cautious, as long-term battery reliability is uncertain.
- Resale Risk: A weak secondary market for EVs results in lower resale values, which discourages lenders by increasing the risk of loss in the event of repossession.
- Utilization Risk: High utilization rates are necessary for E2Ws and E3Ws to be cost-effective, but uncertainty about achieving this erodes lender confidence.
- Credit Risk: Many E3W drivers lack formal credit histories, increasing the perceived risk and resulting in higher interest rates and less favorable loan terms.

Solutions and Financing Frameworks

- **Subsidized Loan Programs:** Government-backed programs, such as interest subventions, can reduce loan costs for EV buyers, making EVs more affordable.
- **State-Specific Loan Initiatives:** Models like Kerala Finance Corporation's low-interest loans can be replicated across other states to encourage EV adoption.
- **Alternative Risk Assessment:** FIs can expand loan eligibility by considering non-traditional credit measures, such as salary slips or contracts with e-commerce platforms, rather than relying solely on credit scores.
- **Separating Battery and Vehicle Ownership:** Decoupling battery and vehicle ownership can significantly reduce upfront costs through models like battery leasing or swapping. This also allows lenders to assess the risks of the vehicle and battery independently, improving financing terms. However, for this to succeed, government action is needed, including GST rationalization, separate vehicle registration, and incentives for battery manufacturers and swapping infrastructure.
- **Interest Subvention Schemes:** Government interest subvention schemes, such as those managed by entities like CESL, can reduce monthly payments for EV buyers. Collaboration with multilateral development banks and OEMs to offer favorable loan terms can further enhance affordability.
- **Risk Sharing Facilities:** Involving national banks, government entities, and international development organizations in risk-sharing mechanisms can reduce lender risks, encouraging more favorable loan terms such as lower interest rates and longer tenures, which are essential for scaling up EV infrastructure and adoption.

E4W Segment

The adoption of E4Ws in India is currently at 2%, with commercial E4Ws slightly higher at 4%. Total cost of ownership (TCO) per kilometer is lowest when E4Ws are used for commercial purposes with high daily utilization rates, typically over 100 km per day, such as by fleet aggregators. This presents an opportunity for widespread E4W adoption in the commercial sector, but several financing challenges need to be addressed to unlock this potential.

Challenges in E4W Financing

- **Limited Financing Options**: A lack of interest from many banks and Non-Banking Financial Companies (NBFCs) in lending for EVs significantly limits financing options for potential buyers, which hinders mass adoption.
- **Lack of Competitive Loan Options:** The limited availability of loan products means buyers often face higher interest rates and less favorable loan terms, further increasing the overall cost of ownership and making EV purchases less financially attractive compared to internal combustion engine (ICE) vehicles.
- **Unestablished Resale Value of Batteries:** With no well-established secondary recycling market for EV batteries, their resale value remains uncertain. This affects the overall resale value of EVs and adds a layer of financial risk, discouraging both buyers and lenders from investing in E4Ws.

The absence of advanced telematics solutions for tracking battery health and performance creates uncertainties about battery longevity and reliability.

Solutions and Financing Frameworks

- **Lower-Cost Financing Options:** Tailored financing models specifically for fleet operators can be introduced to enhance E4W adoption. Given the difficulty for fleet operators with weak financial statements to access traditional credit, alternative financing options like green bonds or climate finance should be made more accessible.
- **Leasing and Battery-as-a-Service Models:** Since batteries account for a large share of an EV's total cost, leasing models—where the battery is leased or rented separately—can significantly reduce the upfront cost of E4Ws. This leasing approach lowers the entry barrier for buyers, making EVs more affordable, particularly for commercial operators.
- **Demand Aggregation Mechanisms:** Centralized agencies like Convergence Energy Services Limited (CESL) can play a key role in aggregating demand, which can lead to substantial reductions in vehicle purchase prices through bulk buying. This demand aggregation can also facilitate access to low-cost financing for fleet operators.
- **Development of Secondary Markets and Battery Recycling:** Building a strong secondary market for EV batteries and establishing recycling mechanisms can improve overall resale value of EVs, reducing financial risk and increasing attractiveness of E4Ws/
- **Telematics for Battery Health Tracking:** Implementing advanced telematics systems to monitor battery health and performance can provide greater transparency to lenders, reducing their concerns over battery lifespan and reliability. This will improve loan terms and build confidence in the long-term viability of E4Ws.

E-Bus Segment

India's electric bus (e-bus) market is growing, driven by government initiatives aimed at decarbonizing public transport. However, financing challenges hinder wider adoption, especially for operators and manufacturers facing high upfront costs and uncertain returns.

- **Inadequate Battery Warranty:** The limited battery warranties (4-6 years) do not match the typical bus lifespan (10 years), exposing operators to high replacement costs and financial risks. Batteries account for 40% of the vehicle's cost, and inadequate warranty coverage reduces asset value, resale potential, and increases maintenance costs.
- **Financial Leverage Risks:** The FAME-II scheme requires OEMs to form special purpose vehicles (SPVs) with high debt finance demands (25% equity, 75% bank-backed). This puts financial strain on OEMs, particularly as delayed payments from State Transport Undertakings (STUs) further affect their cash flow.
- **Delayed Payments:** STUs face financial instability due to insufficient fare collection and rising operational costs, leading to delayed payments to e-bus operators. This impacts the financial stability of operators, complicates project bankability, and increases capital costs.
- **Contractual Bankability:** Revenue risks, uncertain fare structures, and ridership variability challenge the bankability of e-bus contracts. High fixed costs, payment delays, and unbalanced penalties reduce project attractiveness for financiers.
- **High Capital Costs:** E-buses cost 1.5 to 2 times more than diesel buses, requiring significant debt financing (about 70%). Frequent battery replacements and uncertain future costs increase the financial burden and challenge long-term investments.
- **Absence of Secondary Market:** The lack of a secondary market for electric buses limits resale value and reduces financial recovery options for operators. This discourages initial investments and limits fleet expansion.

Solutions and Financing Frameworks

Decoupling Battery and Vehicle Financing: This strategy reduces capex by allowing separate financing for E-bus and batteries. This approach improves risk management for lenders, makes ownership more accessible, and shifts battery maintenance risks to lessors.

- **Model 1:** Financial Leasing and Battery-as-a-Service: Operators purchase e-bus chassis and lease batteries from third-party providers, to be managed by the lessor.
- **Model 2:** Battery Swapping: Operators swap batteries at designated stations, reducing downtime and improving operational efficiency.

Payment Security Mechanism (PSM): A national Payment Security Fund ensures timely payments to e-bus operators, addressing delayed payments from STUs. Mechanisms like a Direct Debit Mandate (DDM) allow the RBI to directly debit state accounts to ensure timely payments, improving contract bankability.

Interest Subvention and Risk Sharing Facility: Offering subsidized loans with interest rates of 4-6% and longer tenures (up to seven years) can ease financial pressure on operators. Coupled with risk-sharing by government, this reduces the perceived risks of lending.

Secondary Market Development for E-Buses: Establishing a secondary market for used e-buses can mitigate concerns about asset recovery. OEMs can support this by introducing buyback schemes, integrating dealer networks, and promoting regulatory incentives to enhance resale value.

EV Charging Segment

Setting up EV charging stations involves substantial upfront investments in hardware, such as charging units, cabling, transformers, and grid connections. High operational costs, including electricity, staffing, and maintenance, further strain financial viability.

Additionally, variable state electricity tariffs, fixed demand charges, complexities in acquiring suitable land, and uncertainties in long-term leases add to the challenges of setting up charging infrastructure.

Challenges in EV Charging Financing

- Technological Risk: FIs hesitate to invest due to a lack of reliable data on charging operations, including daily utilization and maintenance requirements. Rapid technological advancements in EV charging pose the risk of infrastructure becoming obsolete, complicating investment decisions.
- **Policy Risk:** Inconsistent national and state-level policies regarding EV charging hinder the ability of FIs to assess and support investments. The lack of clarity around incentives increases the perceived risk.
- **Manufacturer Risk**: Many EV charger manufacturers are new entrants without a proven track record, making FIs wary of lending for their products due to concerns about long-term performance and service reliability.
- **Low Utilization Rates and Profitability:** Current EV charging station utilization rates in India are low (3-6%),

leading to difficulties in achieving profitability. High operational costs passed on to consumers further reduce station viability.

- **Business Models:** The EV charging business is still evolving, with unproven revenue models and operational strategies. The financial viability of chargers depends heavily on high utilization rates to recover the capital invested.

Solutions and Financing Frameworks

- **Continued Fiscal Incentives:** Sustained fiscal incentives, such as capital subsidies and grants under schemes like FAME, are needed to offset high capex in initial years. Offering tax credits and accelerated depreciation can also improve project economics.
- **Innovative Financing Mechanisms:** Establishing investment funds like Infrastructure Investment Trusts (InvITs) and issuing government-backed green bonds can lower interest rates and attract institutional and environmentally conscious investors. Concessional loans from public sector banks can further make financing more accessible.
- **De-Risking Investments for Financiers:** Train financial institutions to better assess the risks and returns of EV charging stations using centralized data. Deploy risk mitigation tools, including insurance and government-backed risk guarantees, to protect against uncertainties related to technology and low utilization rates.
- **Enhancing Profitability through Innovative Business Models:** Charging operators can increase revenue by tapping into carbon credits or partnering with fleet operators for dedicated charging solutions, offering bulk pricing or subscription models to ensure consistent usage and revenue growth.

E-Freight Segment

India's freight segment is a fragmented market with low regulation and minimal entry barriers. Over 75% of the market consists of small owner-operators, each owning fewer than five vehicles. This dominance of small carriers fragments the market, leading to low returns and high business risks, making it unattractive to creditors. NBFCs finance most new freight vehicles, offering higher interest loans with shorter tenures (typically 3-4 years).

In a market where financing less expensive, conventional trucks is already considered risky, lending institutions perceive financing for Zero-Emission Trucks (ZETs) as even riskier due to their higher costs and uncertainty about future resale value.

Challenges in Financing E-Freight or Zero-Emission Trucks (ZETs)

ZETs are considered risky investments due to the high costs associated with the large batteries required for electric Truc. The relatively new EV truck market presents higher risks for manufacturers compared to established diesel trucks, as limited data on EV performance and warranties increases perceived risk. Uncertainty regarding asset resale value, high battery depreciation, and replacement costs also deter financing in this sector.

Additionally, operators often have weak balance sheets and small-scale operations, creating significant financial challenges. High costs required further strain operators, leading to highly leveraged balance sheets. Truck operators also rely on high utilization to ensure bankability, but the absence of well-defined operational models exacerbates this challenge. Other major risks include the lack of clear state or central policies for the e-freight segment and the insufficient availability of fast-charging infrastructure across highways.

Solutions and Financing Frameworks

Risk Sharing Facility

Financial institutions face difficulties in financing EVs due to perceived high risks, including uncertain resale values and concerns over vehicle performance. This typically results in lending conditions such as lower loan-to-value ratios, shorter tenures, and higher interest rates. Risk-sharing facilities can help distribute these risks by providing guarantees for ZETs through loan reserves. Development banks could finance these facilities, with public sector banks managing them.

Decoupling Battery and Vehicle Financing

To enable leasing, battery swapping, and pay-per-use models, decoupling battery and vehicle financing is essential. This approach allows for distinct risk management for batteries and vehicles, benefiting both financiers and customers. To support this model, governments should streamline vehicle registration procedures, provide subsidies for vehicles sold without batteries, and rationalize GST rates for lithium-ion batteries. Additionally, incentives for battery manufacturers and swapping station operators are critical to advancing the market.

Developing a Secondary Market for EV Freight

Creating a secondary market for used EV freight vehicles can improve their perceived resale value compared to internal combustion engine (ICE) trucks and mitigate financier concerns. This can be achieved through:

- **OEM Involvement:** Introduce buyback schemes and identify eligible models to ensure resale value.
- **Dealer Network Integration:** Provide dealers with training and resources to support the resale of EVs.
- **Market Awareness:** Promote EV freight vehicles and invest in expanding charging infrastructure to support their adoption.

Challenges and Policy/Regulatory Enablers for EV Financing Mechanisms

Addressing the challenges of EV financing and adoption requires a coordinated approach that includes supportive policy and regulatory frameworks. These enablers will be essential in ensuring the successful implementation of innovative financing mechanisms.

1. Decoupling Battery and Vehicle Financing

Challenges:

- Regulatory hurdles prevent the easy sale and registration of vehicles without batteries, which increases the initial cost of purchasing EVs.
- Tax structures, such as higher GST rates on standalone batteries compared to batteries bundled with vehicles, hinder the adoption of battery-swapping models.
- Leasing faces complex tax regulations, with discrepancies between leases and traditional loans. This lack of tax parity makes leasing less financially viable.

Policy/Regulatory Enablers:

- GST Rationalization: Harmonize the GST rate for standalone lithium-ion batteries with that of EVs to encourage battery swapping infrastructure and leasing models.
- Streamlined Vehicle Registration: Revise state-level RTO procedures to facilitate the registration of vehicles sold without batteries, reducing the upfront purchase cost.
- Subsidies: Extend the FAME subsidy to vehicles sold without batteries, incentivizing both EV manufacturers and consumers to adopt battery leasing and swapping models.
- Tax Reforms: Align tax treatment of operating leases with loans to incentivize leasing as a viable option for fleet operators. This includes creating GST parity between leasing vehicles and purchasing them outright.

2. Risk-Sharing Facilities (RSF)

Challenges:

- Financial institutions may be reluctant to lend to the EV sector due to perceived risks related to technology failure, resale value, and battery performance.
- Commercial banks often face difficulties in assessing the creditworthiness of small-scale EV projects, particularly for individuals and fleet operators.

Policy/Regulatory Enablers:

- **Government-backed Risk Sharing:** Establishing government or international development organization-backed risk-sharing mechanisms to absorb a portion of the financial risk, making it more attractive for banks to extend loans.
- **Standardized RSF Products:** Develop standardized RSF products, similar to the Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE), to encourage consistent credit access across the EV sector.

3. Access to Green Bonds and Climate Finance

Challenges:

- High costs associated with the issuance of green bonds (certification, verification, legal fees) deter smaller fleet operators from accessing green finance.
- Limited liquidity and an underdeveloped secondary market for green bonds can restrict market access for smaller issuers.
- Lack of standardization in environmental impact measurements can reduce investor confidence in green bonds.

Policy/Regulatory Enablers:

- **Subsidies and Grants:** Offer government subsidies to offset the high issuance costs of green bonds for small operators, making it easier for them to access green finance.
- **Institutional Framework:** Establish clear, standardized regulatory guidelines for green bonds to improve market transparency and attract more investors.
- **Capacity Building:** Provide technical assistance from development banks to help smaller issuers navigate green bond issuance.

4. Priority Sector Lending (PSL) for EVs

Challenges:

- Financial institutions often perceive EV loans as high-risk due to concerns around battery life, resale value, and technology reliability.
- Adapting existing PSL guidelines and processes to

include EVs is complex, especially with the varying vehicle segments (e.g., 2W, 3W, buses).

Policy/Regulatory Enablers:

- **Amend PSL Guidelines:** The Reserve Bank of India should revise PSL guidelines to include EVs, with sub-targets for different EV segments, such as e-2Ws, e-3Ws, and e-buses.
- **Risk Mitigation Measures:** Implement interest subvention schemes and risk-sharing mechanisms to reduce the perceived risks associated with EV loans, making it easier for banks to meet PSL requirements.

5. Telematics and Data-Driven Financing

Challenges:

- Data privacy concerns around tracking vehicle usage and battery performance through telematics systems, particularly for individual customers.
- High costs associated with installing telematics devices, which can be a deterrent for small-scale operators or lower-margin segments.

Policy/Regulatory Enablers:

- **Data Privacy Regulations:** Establish robust consent management frameworks and align with national data privacy laws to ensure secure handling of vehicle data.
- **Subsidies for Telematics Systems:** Provide financial support for installing telematics devices in EVs, particularly for fleet operators and lower-margin segments like 2Ws/ 3Ws.

6. Developing a Secondary Market for Batteries

Challenges:

- Lack of standardized battery designs and specifications across OEMs complicates the process of battery recycling and reuse, limiting the potential for a robust secondary market.
- High costs of battery recycling technology and infrastructure create financial barriers for companies involved in battery reuse or recycling.

Policy/Regulatory Enablers:

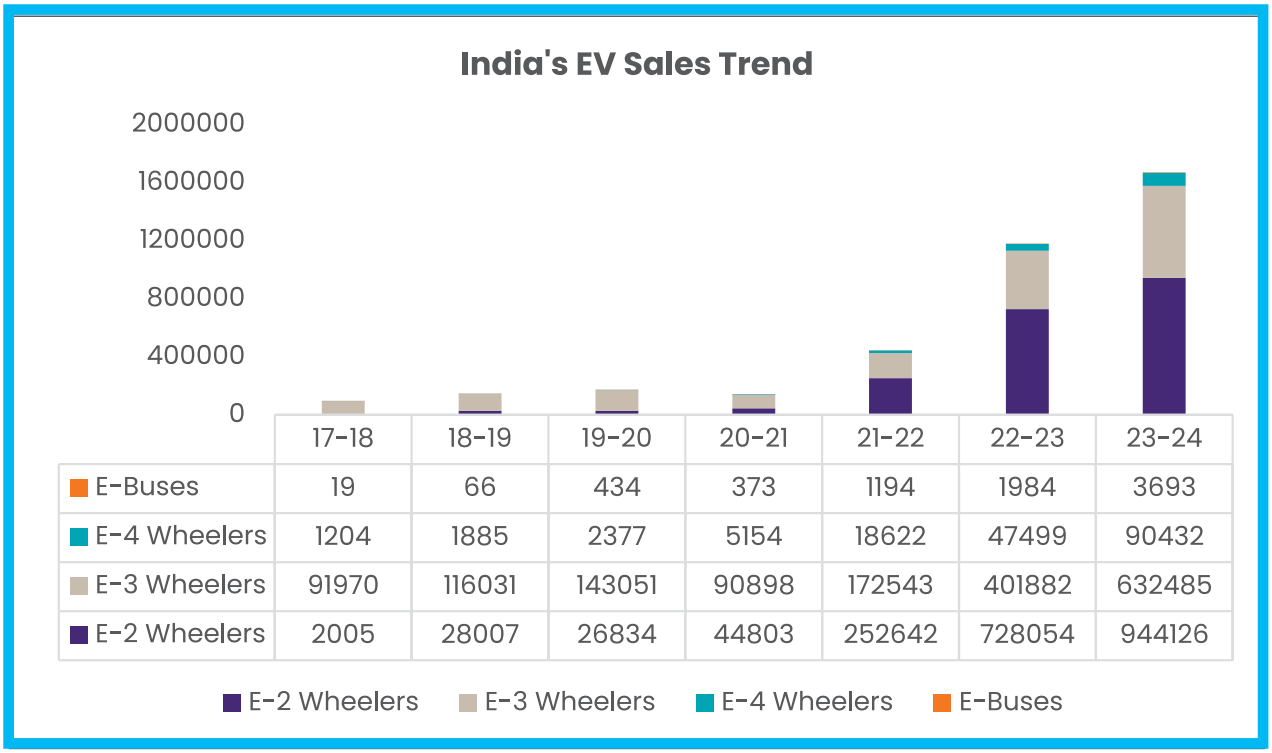
- **Extended Producer Responsibility (EPR):** Strengthen EPR regulations to mandate that OEMs are responsible for the entire lifecycle of EV batteries, from production to disposal.
- **Subsidies for Recycling Infrastructure:** Offer grants and subsidies to support companies developing battery recycling technologies, making the secondary market more viable.
- **Battery Buy-Back Programs:** Develop buy-back programs where OEMs purchase used batteries from consumers, providing financial incentives for proper battery disposal.

01 EV Landscape in India

The EV ecosystem in India is witnessing remarkable growth, driven by various factors such as increasing consumer awareness, rising fuel prices, and government incentives. As the world's third-largest automobile market and one of the fastest-growing automotive markets, India is well-positioned to capitalize on the EV revolution.

With a current market size of Rs. 12.5 lakh crore (USD 151 billion) and an expected doubling to Rs. 24.9 lakh crore (USD 300 billion) by 2030, the Indian automotive sector contributes significantly to the country's GDP at over 7.1%. the EV market is projected to grow at a CAGR of 49% from 2022-2030, with major contributions from the electric two-wheeler (e-2W) and electric three-wheeler (e-3W) segments. [1]

The reduction in upfront costs, increased awareness about the benefits of EVs, and continued central and state-level subsidies have fueled higher EV sales in the e-2W and e-3W segments. As a result, India's EV sales reached an impressive 3.85 million units as of March 2024[2], reflecting a CAGR of around 58% over the last five years.



	17-18	18-19	19-20	20-21	21-22	22-23	23-24
E-Buses	19	66	434	373	1194	1984	3693
E-4 Wheelers	1204	1885	2377	5154	18622	47499	90432
E-3 Wheelers	91970	116031	143051	90898	172543	401882	632485
E-2 Wheelers	2005	28007	26834	44803	252642	728054	944126

Figure 3: India's EV Sales Trend

The Indian government has taken progressive steps to accelerate EV adoption, leading to growing demand. According to NITI Aayog's projections , by 2030, the penetration of various EV categories is likely to be as follows:

- 35-40% for two-wheelers
- 9-11% for private four-wheelers
- 20-25% for shared four-wheelers
- 13-16% for buses

However, several structural challenges need to be addressed to spur increased EV adoption. EVs are currently priced higher than internal combustion engine (ICE) vehicles, and consumer concerns over affordability, range anxiety, and inadequate charging infrastructure persist. Despite robust sales of 1.67 million EVs in FY2024, EV penetration in India remains low due to these concerns.

To overcome these challenges and sustain the growth momentum, stakeholders in the EV ecosystem must collaborate to develop innovative solutions. This could

[1] ICICI Bank Research
[2] Fuel-wise 2-Wheelers Sales, Vahan Dashboard
[3] NITI-BCG Report - Promoting Clean Energy Usage Through Accelerated Localization of E-Mobility Value Chain

include expanding charging infrastructure, introducing attractive financing options, and promoting public awareness campaigns to address range anxiety and affordability concerns. By addressing these challenges, India can unlock the full potential of its EV market and become a global leader in sustainable mobility.

1.1 Current EV Policy Landscape in India

The Indian government has adopted a comprehensive array of policies and initiatives to promote the adoption of electric vehicles (EVs). These measures aim to address challenges related to high upfront costs, limited charging infrastructure, and consumer awareness. The policies involve multiple stakeholders, including various ministries, state governments, and advisory bodies.

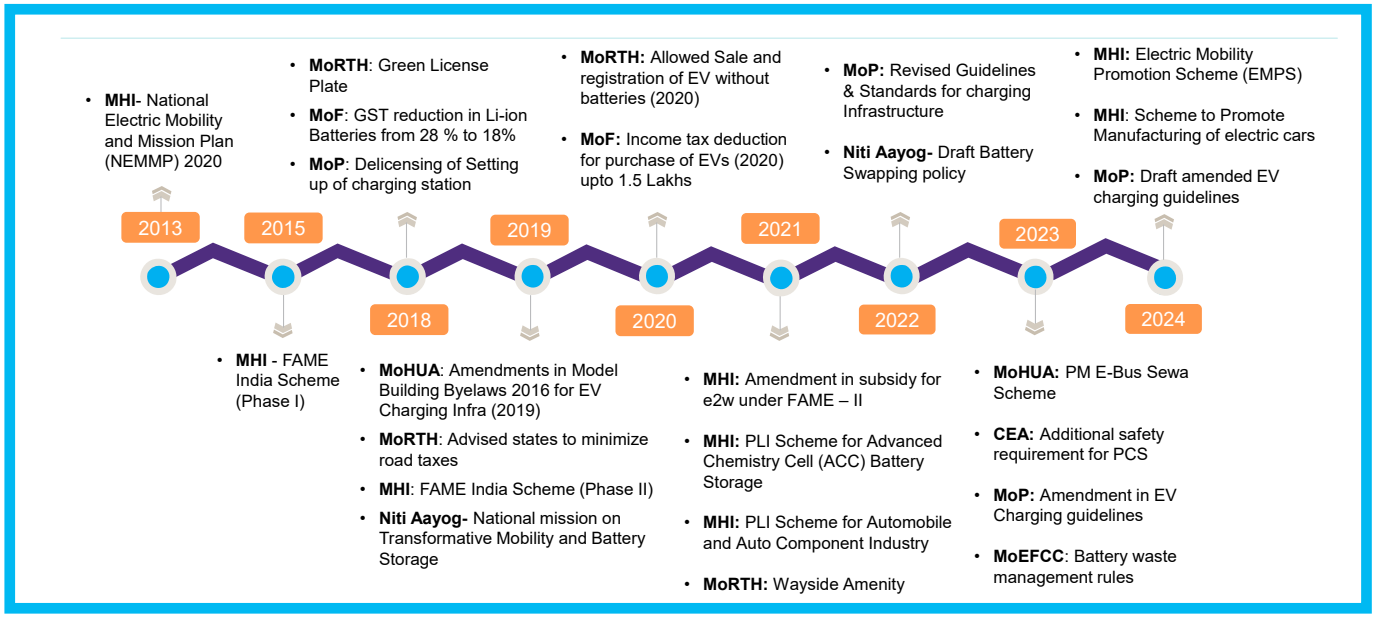


Figure 4: Timeline of Policies related to the EV ecosystem

1.1.1 Demand-Focused Policies

- **National Electric Mobility Mission Plan (NEMMP) 2020** [4]**:** NEMMP 2020, launched in 2013 by the Ministry of Heavy Industries and Public Enterprises, is a central government scheme designed to boost the use of electric and hybrid vehicles in India.
- **FAME India Scheme:** The Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme was initiated in 2015 by the Department of Heavy Industry. The first phase supported about 280,000 xEVs and 425 electric/hybrid buses until March 2019. The second phase, FAME II, launched in April 2019 with a budget of INR 10,000 crore (approximately USD 1.4 billion), aimed to support the electrification of public and shared transportation, aiming to support 1 million electric two-wheelers, 500,000 electric three-wheelers, 55,000 electric four-wheelers, and 7,000 electric buses.
- **Electric Mobility Promotion Scheme (EMPS)**[5]**:** Introduced by the Ministry of Heavy Industries after the conclusion of FAME II, the EMPS has set up a fund of INR 500 crore to support the adoption of electric two-wheelers (e-2W) and three-wheelers (e-3W) across India. The scheme aims to support 333,387 e-2Ws and 38,828 e-3Ws.
- **State-Level Policies:** Various state governments have introduced policies and incentives to promote EV adoption. For example, Delhi's EV policy offers subsidies up to INR 30,000 for electric two-wheelers and INR 1.5 lakh for electric cars. Several states, including Delhi, Maharashtra, Gujarat, and Tamil Nadu, have introduced their own incentives, such as subsidies, road tax exemptions, and registration fee waivers to promote EV adoption.

1.1.2 Supply-Focused Policies

- **National Mission on Transformative Mobility and Battery Storage: Launched in March 2019, this mission aims to develop the battery industry, charging infrastructure, and local supply chains, promoting India as a manufacturing and export hub. The mission supports the establishment of large-scale,** export-

[4] NEMMP Policy Document
[5] E-Mobility Promotion Scheme Policy Document

competitive integrated batteries and cell-manufacturing giga plants. This enabled supply side interventions in India.

- **Phased Manufacturing Program (PMP) for EV Parts:** This program, introduced by the Ministry of Heavy Industries, promotes the domestic manufacturing of EV components and battery packs through a graded duty structure. Another PMP for Electric/Hybrid (xEV) Parts defines the indigenization timeline for xEV parts to avail incentives under FAME II. Additionally, the PMP for EV charger parts and accessories requires manufacturers to achieve at least 50% indigenization to avail incentives within the FAME II scheme.
- **Performance Linked Incentives (PLI) Scheme for Advanced Chemistry Cells (ACC)[6]:** With an allocation of INR 18,100 crore, this scheme offers financial incentives for setting up manufacturing facilities for EVs and batteries in India. Administered by the Ministry of Heavy Industries, the scheme aims to establish Giga scale ACC manufacturing facilities with a total capacity of 50 Giga Watt hours (GWh).
- **Production-Linked Incentive (PLI) Scheme for Automobile and Auto Components[7]:** Effective from April 1, 2022, with a budgetary outlay of INR 25,938 crore, this scheme focuses on domestic manufacturing of EVs and critical components like batteries and electric motors.
- **State-Specific Policies:** Several states, such as Andhra Pradesh, Uttar Pradesh, Tamil Nadu, and Telangana, offer supply-side incentives to attract investment and generate employment. These include capital interest subsidies, stamp duty reimbursements, tax exemptions, SGST reimbursements, and interest-free loans for EV manufacturers.

1.1.3 Charging Infrastructure

a) **Ministry Of Heavy Industries:** MHI sanctioned around 520 charging stations/infrastructure projects with a budget of approximately Rs. 43 crores under Phase-I of the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) Scheme. This resulted in the establishment of 452 charging stations in various cities across India under FAME-I. [8]

For Phase-II of the FAME India Scheme, a budget of Rs. 1000 crore has been allocated over five years (2019-20 to 2023-24) to develop charging infrastructure. FAME-II included subsidies of up to 70% for commercial public charging stations and 100% for non-commercial government/institutional charging stations are provided, based on the cost of the EV supply equipment.

b) **Ministry of Power:** MoP has issued EV Charging Infrastructure Guidelines for setting up private and public charging stations, covering aspects like land use, electricity tariffs, and installation timelines.

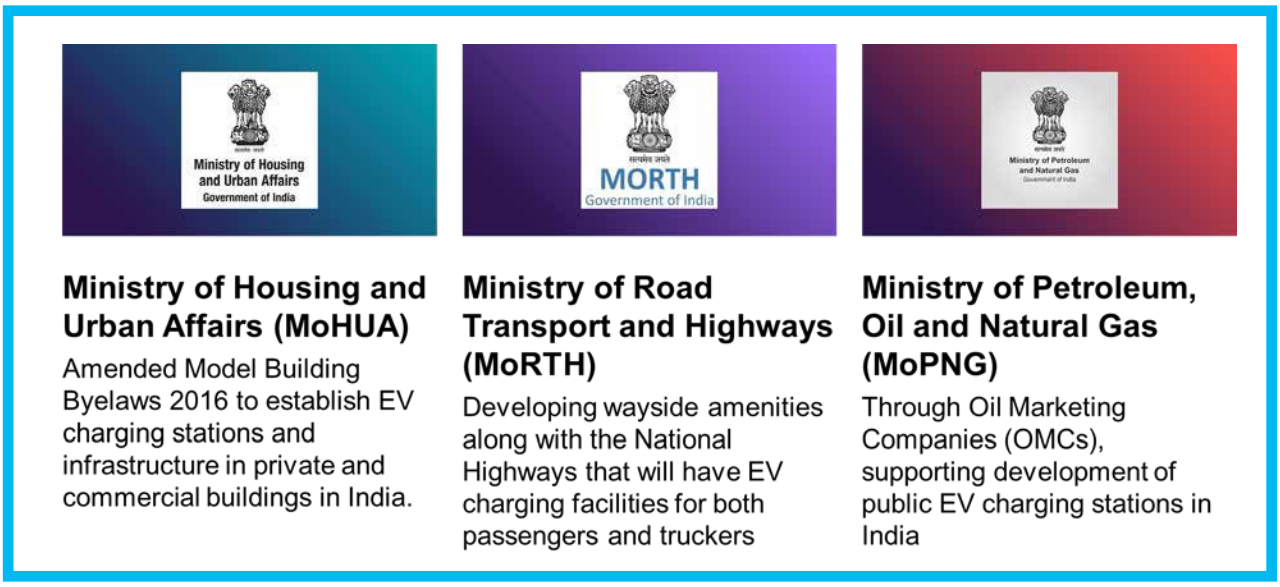


Figure 5: Role of Line Ministries in EV Charging Infrastructure

c) **Battery Swapping Policy (Draft)**: Led by NITI Aayog, the draft battery swapping policy aim to catalyze the large-scale adoption of EVs by improving efficient and effective use of resources for the delivery of customer centric services. It proposes that EVs with swappable batteries receive the same incentives as those with fixed batteries, with incentives based on the battery's kWh rating.

[6] PIB Press Release on PLI scheme for Advanced Chemistry Cell (ACC)
[7] Production Linked Incentive (PLI) Scheme for Automobile and Auto components Policy Document
[8] PIB Press Release on Charging Stations sanctioned by MHI

1.1.4 Tax Policies

a) **GST Reduction and Income Tax Benefits:** To make EVs more affordable, the Goods and Services Tax (GST) on EVs has been reduced from 12% to 5% and Electric buses having occupancy capacity of more than 12 people exempted from GST. Buyers of EVs are also eligible for an income tax deduction of up to INR 1.5 lakh on the interest paid on loans taken to purchase EVs. (it was valid till FY23)

b) **Custom Duty:** To promote domestic EV manufacturing, India has implemented a differential taxation structure for imported and domestically manufactured EVs. Completely Built Units (CBUs) of EVs attract high customs duties (60% if CIF value is above $40,000 and 100% if below $40,000), while Completely Knocked Down (CKD) units attract a lower duty of 15%. This encourages local assembly and manufacturing, aligning with the government's 'Make in India' initiative.

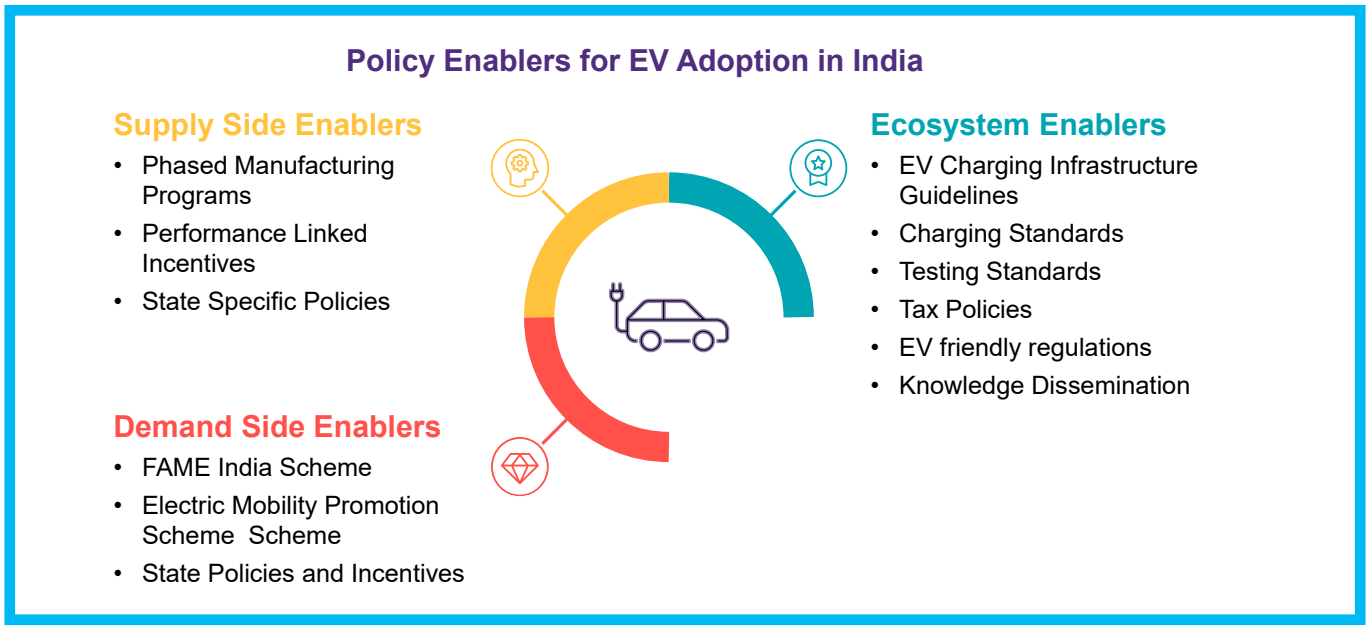


Figure 6: Policy Enablers for EV Adoption in India

These policies and measures, implemented by various government bodies and supported by state governments, aim to create a comprehensive ecosystem for increased adoption of electric vehicles in India, reducing the country's dependence on imported EVs and promoting sustainable transportation solutions.

1.2 Barriers and Challenges of EV Adoption in India

The electric vehicle (EV) market in India is experiencing promising growth. However, several barriers and challenges must be addressed to achieve widespread adoption. These challenges span various segments and require targeted interventions. Below is a detailed analysis of these barriers:

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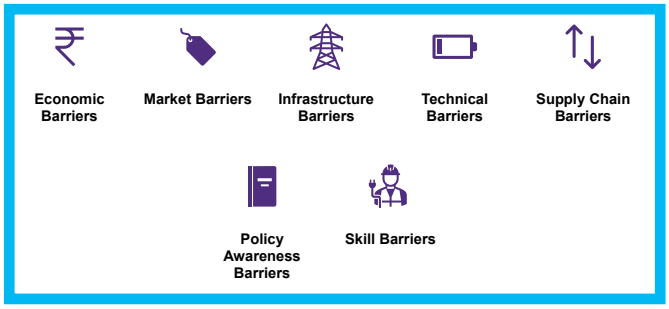

Figure 7: Barriers and Challenges for EV Adoption in India

1.2.1 Financing Barriers

Despite various government measures aimed at making electric vehicles more affordable, high upfront costs, limited financing options, and elevated insurance premiums continue to impede widespread adoption.

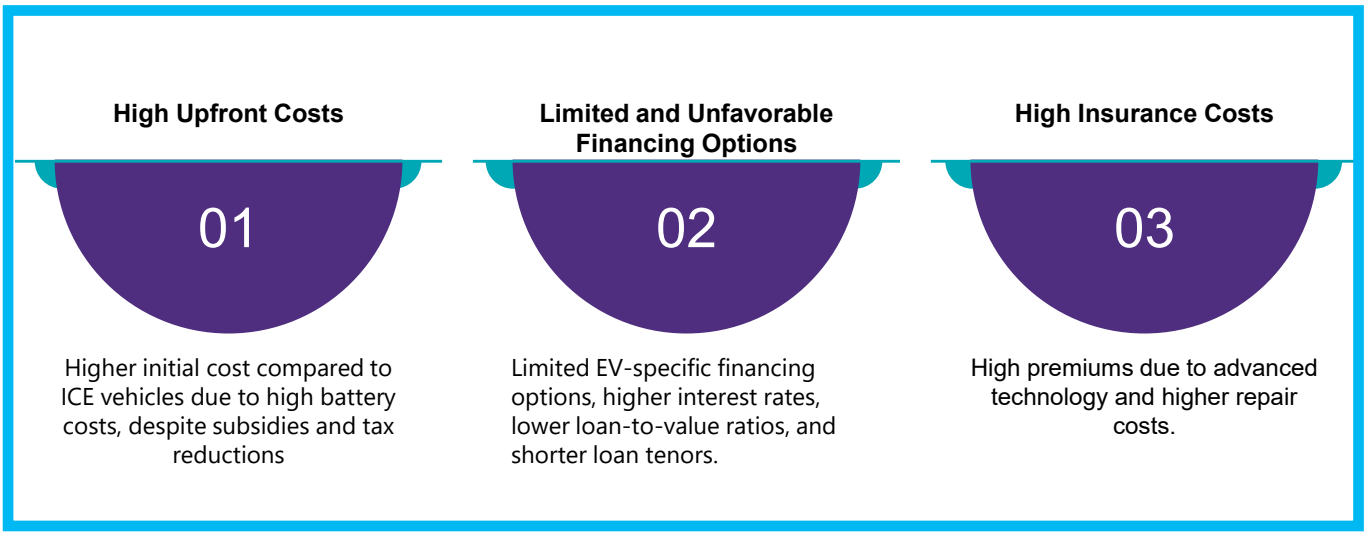

Figure 8: EV Financing Barriers

a) **High Upfront Costs:** The initial cost of EVs particularly four-wheelers, remains significantly higher than that of internal combustion engine (ICE) vehicles. This cost disparity is primarily due to the high cost of batteries, which constitute a major portion of an EV's total cost.

   Hence, Strategies to further reduce both upfront costs and total costs of ownership (TCO)[9] through financial incentives and technological advancements are essential.

b) **Limited and Unfavorable Financing Options:** Financing options specifically tailored for EVs are limited. Potential buyers face higher interest rates, and lower loan-to-value ratios compared to ICE vehicles, resulting in higher down payments and monthly installments. Additionally, the nascent EV ecosystem increases perceived risks for financiers, leading to shorter loan tenors.

c) **High Insurance Cost:** In addition to paying a higher upfront cost, customers also pay higher insurance premiums. EVs contain sophisticated technology such as lithium-ion batteries, IoT devices, etc. that require high-skilled mechanics for servicing.

   Additionally, though EVs contain fewer parts than their ICE counterparts, their components are considerably more expensive given their advanced technology. Moreover, these parts are not yet easily available in India, and often must be imported.

d) **Lack of Established Secondary Market:** The resale value of EVs is currently low due to the underdeveloped secondary market. The uncertainty surrounding the resale value of EVs, particularly those without batteries, deters potential buyers. Additionally, the secondary market for EV batteries is unstructured.

1.2.2 Infrastructure Barriers

a) **Inadequate Charging** Infrastructure: Despite efforts by the government and private sector to expand the charging infrastructure, it remains inadequate to meet the growing demand. Consumers hesitate to purchase EVs due to range anxiety, while charging point operators are cautious about installing chargers due to lower utilization.

b) **Inadequate Electric Supply Network:** With the rise in charging infrastructure use, there will be a rapid increase in the load on the electricity grid. The higher electrical power consumption due to EV integration has substantial influence on the distribution network, causing lower bus voltages, higher distribution losses, higher harmonic distortion, voltage drops, frequent power outages, and reduced efficiency.

1.2.3 Supply Chain Barriers

a) **Import Reliance:** India currently relies heavily on imports for critical components such as lithium-ion batteries and advanced electronics. This dependency affects the overall cost and supply chain stability of EVs.

[9] While TCO is already favorable for e-2W and e-3W segments, parity for e-4W and buses are yet to be achieved.

b) **Battery Technology and Recycling:** Lithium-ion batteries, while popular, pose challenges related to lifespan, efficiency, and environmental impact from lithium mining. Additionally, the lack of established recycling infrastructure and regulations for battery disposal exacerbates these issues.

1.2.4 Awareness and Skill related barriers

a) **Policy Implementation and Consumer Awareness:** Although the government has introduced policies to promote EV adoption, their implementation at the ground level is often inconsistent. Additionally, consumer awareness about the benefits of EVs and available incentives remains low.

b) **Shortage of Skilled Labor:** A skilled workforce is crucial for the manufacturing, service, and maintenance of EVs. Currently, there is a significant gap in the availability of trained personnel.

Addressing these barriers comprehensively requires coordinated efforts from the government, industry stakeholders, financial institutions, and educational bodies. Through targeted interventions and sustained efforts, India can overcome these challenges and accelerate the adoption of electric vehicles.

1.3 Consultative Approach

To develop a comprehensive understanding of the challenges in EV financing in India and to pinpoint the necessary financing interventions for various vehicle categories, consultations were held with over 35 stakeholders from across the ecosystem.

This included discussions with Development Financial Institutes (DFIs) and think tanks to understand their ongoing programmatic interventions in the EV segment, future plans, and pipeline projects for low-carbon transport. These discussions also helped assess the challenges and opportunities in financing e-mobility projects, including barriers faced by DFIs, and evaluate the risks and potential solutions that DFIs foresee to mitigate these risks for financial institutions (banks and NBFCs).

Additionally, consultations were held with OEMs across 2W, 3W, 4W, and E-bus categories, as well as with state and city-level transport authorities. From an OEM's perspective, challenges were detailed to understand the reasons for pain points faced by customers and the potential support required by financiers to offer competitive products for electric vehicles. A list of stakeholders consulted for this study is provided in Annexure 1.

02 Vehicle and EV Financing Landscape in India

2.1 Vehicle Financing Landscape

India's retail finance industry has undergone significant transformation. The distribution of finance from the organized sector, which includes banks and non-banking financial companies (NBFCs), is as follows:

1. **4W Passenger Vehicles (PVs):** 50% of the total finance flows to this segment, reflecting its substantial market share and consumer preference.
2. **Commercial Vehicles (CVs):** 40% of financing is directed towards commercial vehicles, indicating the crucial role these vehicles play in India's growing economy.
3. **Tractors and Two-Wheelers:** These segments receive the remaining 10% of finance, highlighting their lesser, yet significant, financial engagement compared to PVs and CVs.

Financing Penetration by Segment: The extent to which vehicles are financed through loans by the organized sector varies significantly across different segments:

1. **Two-Wheelers:** The financing penetration ranges from 35 to 50 percent. This variability can be attributed to the wide range of uses and economic accessibility of two-wheelers.
2. **Four-Wheeler PVs:** Approximately 80 percent of all 4W passenger vehicles are purchased using finance, underscoring the segment's robust market dynamics and consumer trust in financing options.
3. **Commercial Vehicles:** For new light, medium, and heavy-duty commercial vehicles, financing penetration is remarkably high at about 95 percent.

Loan Characteristics:

1. **Loan Tenures:** Across most vehicle segments, loan tenures tend to range between 3-5 years, with the exception of two-wheelers where the tenure is typically shorter.
2. **Loan-to-Value (LTV) Ratios:** These ratios vary significantly; for two-wheelers, it ranges from 70 to 75 percent of the vehicle's value, whereas for commercial vehicles, it can be as high as 80 to 90 percent.
3. **Interest Rates:** Interest rates on vehicle loans are predominantly floating rather than fixed, and they vary considerably across different lenders and vehicle segments.

2.2 EV Financing Landscape

Presently, the Indian EV financing sector commands a valuation of USD 4.37 billion, with projections indicating a surge to USD 53 billion in the coming six years (by 2030). EV's can be classified into private vehicles and commercially used vehicle based on use-cases.

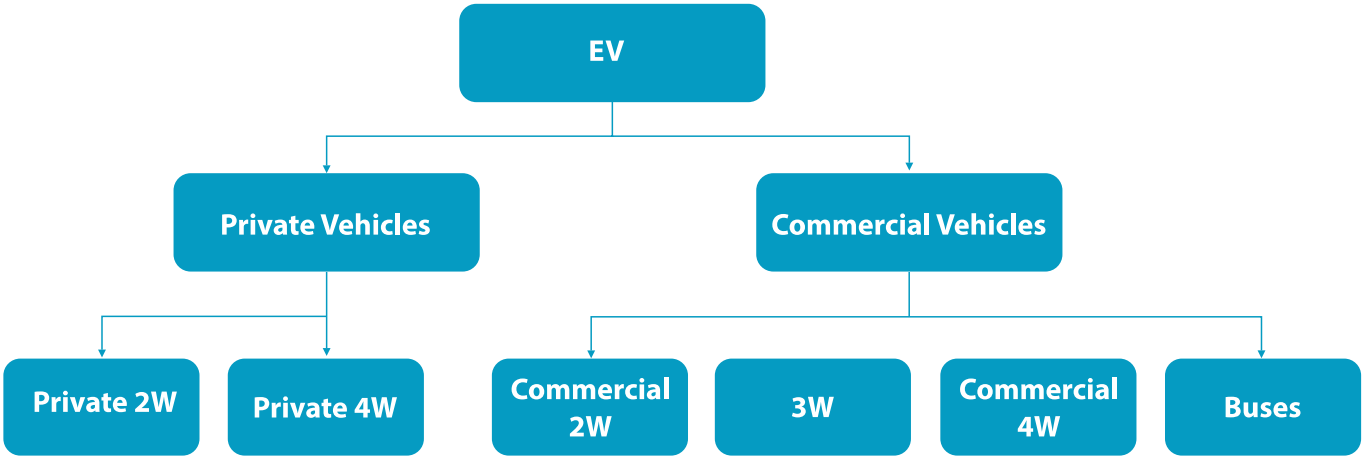

Figure 9: Categorization of EVs based on ownership and use-cases

2.2.1 Private Segment

The asset risk is perceived to be high due to which there are limited options available currently and the loan terms are unfavorable compared to ICE for both low-speed and high-speed two-wheelers and three-wheelers EVs. For high-speed vehicles, the primary lenders are NBFCs.

Few banks, who are willing to lend, do so only to select OEMs offering high speed vehicles. NBFCs have stronger credit requirements for low-speed vehicles with justifying documents for a longer period of 6 months compared to 3 months typically for ICE vehicles. On the other hand, there is no difference between credit checks for high-speed EVs compared to ICE. For high-speed EVs, banks however maintain a stricter credit assessment vs ICE loans.

- Loan terms for Low-speed two-speed vehicles the Interest rates charged by banks are 2-6% higher compared to ICE, while delta for NBFCs can be even higher. LTV offered is 10-30% lower while tenure available is also much lower (15-24 months vs 46-52 months for ICE). [10]
- High speed vehicles typically attract an interest differential of 2-6% compared to ICE for banks while 1.5-3% for NBFCs. These are coupled with 10-25% lower LTV and lower tenor (24-36 months vs 46-52 months for ICE).

Perceived Risks in EV Financing for private vehicles

Considering the above factors, financiers design their loan terms accordingly to mitigate these risks. To limit their capital at risk, financiers only provide partial loan value of the vehicle. Upto 90% of the vehicle with higher interest rates to cater to the concerns around OEM credibility, product quality & resale value. Uncertainty of battery life is handled by matching the loan tenures with the warranty offered on the battery, resulting in lower tenures of 2-4 years for 2W loans.

On the other hand, 4Ws are offered with similar financing options as of ICE. Banks are the primary lenders in the personal 4W segment, and as the 4W EV options available in India are provided by reliable OEMs, eligibility criteria, documentation, or turnaround time for approval for EV loans are comparable to ICE vehicles. In fact, as a support to the government's effort to promote EVs, there are green loans available with some banks like State Bank of India and Union Bank, which offer a 20-25 bps (basis point) discount along with higher tenure of up to 10 years.

2.2.2 Commercial Segment

In the commercial sector, including 2-wheelers, 3-wheelers, 4-wheelers, and E-buses, assets are typically financed based on the earnings generated from these vehicles. Consequently, a customer's creditworthiness depends on both asset utilization and business viability, making credit risk assessment more complex. Additionally, asset usage in this segment is significantly higher than in the personal segment, leading to increased concerns of asset risk.

In the commercial space, 2-wheelers are commonly used by e-commerce players for food and parcel delivery. These vehicles are generally purchased by startups or aggregators rather than individual buyers, so assessing the creditworthiness of the firm and the viability of its business model plays a crucial role in determining credit risk. The excessive utilization of these assets also highlights the asset risk in this sector.

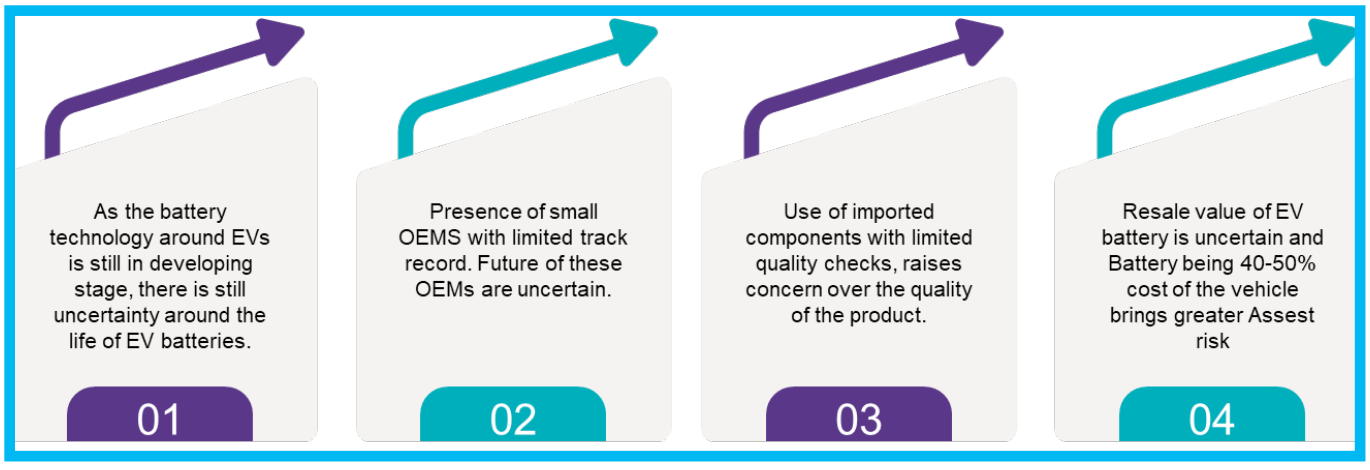

Figure 10: Perceived Risks in EV Financing

[10] https://www.niti.gov.in/sites/default/files/2023-07/ADB-EV-Financing-Report_VS_compressed.pdf

Challenges in Financing:

- **Limited Financing Options:** Very few Non-Banking Financial Companies (NBFCs) and even fewer banks are willing to finance commercial loans for 2-wheelers (both high-speed and low-speed).
- **Selective Loan Eligibility:** Some NBFCs are unwilling to lend to proprietary firms or firms with more than three partners. Additionally, for loans in an individual rider's name, NBFCs typically lend only if the company is an established third-party logistics (3PL) provider or if the end-client for the 3PL is a large e-commerce player.
- **Unfavorable Loan Terms for EVs:** Compared to internal combustion engine (ICE) vehicles, loan terms for EVs are less favorable, especially for low-speed vehicles.
    - **Low-Speed Vehicles:**Interest rates are 4-6% higher than for ICE vehicles, with 10-25% lower loan-to-value (LTV) ratios and shorter loan tenors (12-18 months vs. 12-24 months for ICE).
    - **High-Speed Vehicles:** Interest rates are 2-8% higher than for ICE vehicles, with 4-12% lower LTV ratios. However, the loan tenor remains the same as for ICE vehicles, since the warranty on the battery matches the maximum tenor offered for ICE loans (18-30 months).

Electric 3Ws are both privately owned and also by the fleet operator for passenger and cargo segment. Since the customer profile in this segment usually belongs to the low-income group individual creditworthiness plays an important role in assessing credit risk and eligibility for loans. On the financing side, e-rickshaws have been a major success story.

- Many nonbank financial corporations (NBFCs) and banks have partnered with original equipment manufacturers (OEMs) to fund e-rickshaws after due diligence for tenor of up to 2 years in most cases.
- Micro Units Development and Refinance Agency (MUDRA) loans are also accessed for purchase of electric 3Ws.
- LTV of 80.0% is offered, and though interest rates offered by NBFCs typically charge 1-7% higher interest rates for passenger 3Ws compared ICE and 1-8% higher rate for cargo EVs vs ICE.

Commercial Electric 4Ws are used primarily in 2 applications, corporate fleets and passenger services fleets (BLU Smart, EEE Cabs, OLA, Uber, etc.). Loan eligibility and loan terms are determined based on cash flow profiles of these businesses.

Companies like Blu Smart that use electric four-wheelers for passenger mobility experience lower risks. The asset risk is low due to the maturity of the technology, which means the vehicles are reliable and require less maintenance. The business model risk is medium, as the demand for passenger mobility services can fluctuate but is generally stable. The credit risk is low because the predictable daily use of the vehicles ensures consistent revenue, making it easier to manage and repay loan

- When it comes to the commercial EV space, all banks & NBFCs lending to 4W ICE customers are willing to lend for EV models.
- However, banks selectively lend to companies with an existing fleet greater than 50 or those servicing corporate customers given higher stability of cashflow vs fleets targeted for passenger services. Businesses falling outside this segment are generally financed by NBFCs.
- Interest rates are around 0.5%-2% higher for EVs compared to ICE. The delta in interest rates is more pronounced for fleets used for passenger services. LTV offered for commercial EV loans is 10-20% lower while tenor is lower only for passenger fleets (3 years vs 4-5 years for ICE and corporate EV fleets).

From a customer perspective in the commercial category, lending practices remain selective along with stricter credit assessment for both EVs and ICE. However, for EVs, customers have to pay higher down payments because of lower LTVs and higher EMIs due to higher interest rates and lower tenors. In case of 3Ws, they have to bear an additional recurring capex for battery replacement every 4-5 years as well. Financing options for this recurring capex are currently very limited.

In current scenario Electric buses are primarily used for passenger transportation. These buses are mainly managed by corporate organizations and fleet operators. E-buses show greater attractiveness and comfort to financial institutions for retail lending.

For e-buses, debt finance requirements make it difficult for operators to purchase fleets. Debt finance requirements mandate 25.0% equity, and the balance of 75.0% requires bank guarantees and collateral, with a fee of up to 0.5%–1.5%. [11]

[11] https://www.adb.org/sites/default/files/publication/945841/sawp-099-electric-vehicle-financing-india.pdf

Segment	Technology	Average Market Price	Interest Rate	LTV Ratio	Tenure
E2W	ICE	0.90 lakhs	10-21%	80-90%	3-4 years
	EV	1.35 lakhs	15-25%	75%	2-3 years
E3W	ICE	3.0 lakhs	10-22%	80-85%	3-5 years
	EV	4.5 lakhs	18-23%	70-80%	3-4 years
	E-Rickshaw	1.5 lakhs	21-35%	75%	1-2 years
E4W	ICE	7 lakhs	Comparable	Comparable	4-5 years
	EV	12 lakhs			3-4 years

Table 4: Summary of EV Financing Lending Terms across Vehicle Segments

2.3 Key Stakeholders in vehicle financing

The landscape of vehicle finance in India is diverse, comprising various stakeholders categorized into banks, NBFCs, and fintech companies. NBFCs dominated the vehicle finance industry, but recently, private, and public banks as well as original OEM-owned captive vehicle financiers became significant players.

Recently, fintech companies have also entered the market, focusing on digital lending for vehicles. Banks primarily focus on 4W passenger vehicles, while captive NBFCs are more active in 2W lending, and non-captive NBFCs play a prominent role in the commercial vehicle segments.

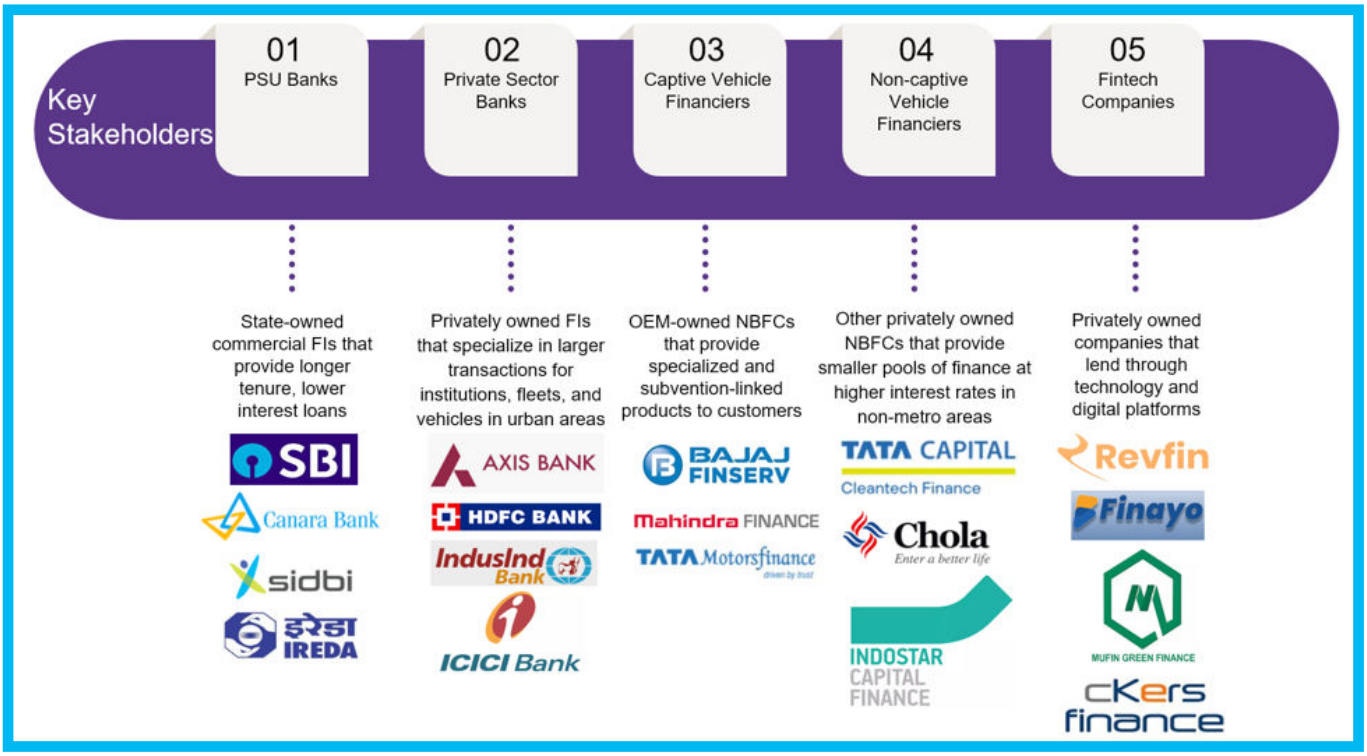

Figure 11: EV Financing Stakeholders (Banks and NBFCs)

2.4 Financing Mechanism for EVs

Much of the EV transition in India is being supported by Multilateral Development Banks (MDBs) and national development banks such as SIDBI and IREDA, PSU banks and private financial institutions. In this scoping report,

Various mechanisms are employed to support different market segments, from individual consumers to fleet operators. Diverse financing mechanisms are already being implemented in India, demonstrating their potential to overcome financial barriers and accelerate EV adoption.

2.4.1 EV Financing Initiatives by Development Financial Institutes

The major EV financing initiatives by DFIs include:

Projects	Objective	Funding (USD million)	EV Segment
Electrifying Mobility in Cities: Investing in the Transformation to Electric Mobility in India	Catalyze access to finance for a large-scale adoption of EV across vehicle segments. 1. **Integrated EV Policy**: An e-Mobility policy and a Comprehensive e-Mobility Plan (CEMP) have been institutionalized. 2. **Battery Management**: A reuse and recycling policy for Lithium-Ion Battery (LIB) and battery standards for EVs have been endorsed. 3. **Pilot Demonstrations**: Conditions for e-mobility investments have been created with pilot projects planned in various cities. Pilot projects for the deployment of 500 e-2Ws, 500 retrofitted e-3Ws, and 3500 e-4Ws are planned in various cities, aiming to mitigate 201 KtCO2eq emissions by 2032. 4. **Capacity Development**: Demand for e-vehicles will be stimulated through increased capacity and awareness, with training programs for women in place.	168	2W,3W,4W
Program for Transformative Mobility and Battery Storage: Environmental and Social Systems Assessment	Accelerate green transition in transport and energy sector. USD 750 million is allocated for India's renewable energy and EV transition. It's divided into three phases of USD 250 million each: 1. **Phase 1**: Scales up battery energy storage system investments. 2. **Phase 2**: Supports green charging infrastructure and two-way grid-EV communications. 3. **Phase 3**: Accelerates electric bus adoption. An additional USD 250 million is for transitioning from internal combustion engine 2/3 wheelers to electric versions.	1000	2W, 3W, Buses
GreenCell Electric Bus Financing Project	Finance procurement of E-buses and development of allied infrastructure Project Outcomes: 1. **Green Transport Expansion**: By 2025, 250 e-buses will be operational, 50 of which are powered by renewables. This will provide 50.6 million vehicle kilometers per year and avoid 14,780 tons of CO2 emissions. 2. **Gender-Sensitive E-Bus Development**: By 2024, 125 chargers and a 9 MWh battery energy storage system will be installed at bus depots. All 250 buses will have women-friendly safety features.	79	Bus
IREDA Loan Sanction to Blu Smart	Indian Renewable Energy Development Agency Ltd. (IREDA) sanctioned a loan of Rs. 267.67 crores to Blu Smart Mobility for the purchase of 3,000 all-electric leading to an expansion of its' EV fleet. From the sanctioned loan of Rs. 267.67 crores, the first tranche of Rs. 35.70 crores have been disbursed by IREDA to the company. [4]	31.8	4W

[12] PIB Press Release

Projects	Objective	Funding (USD million)	EV Segment
EVOLVE Initiative	The EVOLVE initiative, requested by the Indian Government, aims to boost financing for electric 2-wheelers and 3-wheelers and their charging infrastructure. In collaboration with the World Bank, SIDBI will provide affordable EV loans to MSMEs, including telematics to reduce costs and provide financial data. [13]	125	2W,3W
Payment Security Mechanism	The Payment Security Mechanism (PSM) is key to the PM eBus Sewa initiative, which aims to deploy 10,000 made-in-India electric buses. The PSM reduces financial risks, facilitating electric bus procurement and operation, and is expected to unlock $150 million in investment. It ensures timely payments for electric bus operations, attracting private investment for sustainable transport. [14]	150	Bus
SIDBI and Shell Foundation RSF	SIDBI and the Shell Foundation have launched a USD 6 million Risk Sharing Facility (RSF) to boost the adoption of electric two-wheelers and three-wheelers in India. The RSF, aligning with India's EV30@30 mission, aims to facilitate the procurement of 50,000 EVs by providing a partial credit guarantee to commercial EV players.	6	2W,3W
Climate-friendly Modernisation of Urban Public Transport in Tamil Nadu	Under the Indo-German cooperation, KfW and the Tamil Nadu Government have signed a loan agreement of EUR 200 million for public transport modernization and expansion. The funds will be used to procure 500 electric buses and approximately 2200 BS-VI standard diesel buses. The project also aims to enhance user experience and sustainability through digitalization and cashless payment systems.	107	Bus

Table 5: EV Financing Initiatives by DFIs

2.4.2 EV Financing loan programs

2.4.2.1 Green Car Loans by Financial Institutes

The following table summarizes key features of green vehicle loan programs offered by prominent banks in India:

Bank	Program	Feature
State Bank of India	Green Car Loan[15]	Offers a flexible repayment period ranging from 3 to 8 years with attractive interest rates from 8.75% to 9.45%. It provides a 25-basis points concession on the applicable interest rate for standard car loans. The loan covers up to 90% of the vehicle's on-road price, with some models qualifying for 100% financing.
Union Bank of India	Green Miles[16]	Interest rate varies depending on credit score (9.15%- 12.25%). No prepayment penalty if the loan adjusted from its own verifiable source. The repayment period for a new electric four-wheeler is 84 months, while for a new electric two-wheeler, it is 36 months (60 months under a tie-up agreement).
Punjab National Bank	Green Car Loan	For new cars, the bank offers 10% of the on-road price or 0% of the ex-showroom price, meaning that the ex-showroom price is fully financed. It offers 25% of the on-road price will be refunded towards the purchase of a new EV.

[13] Unlocking E-Mobility Complementing EV30@30, SIDBI
[14] COP28 Side Event on PSM
[15] Green Car Loan by SBI
[16] Green Miles Program by Union Bank of India

Bank	Program	Feature
Bank of Maharashtra	Maha Super Green Car Loan[17]	Bank of Maharashtra does not charge processing fee and documentation charges on electric green car loan scheme. The bank offers 0.25% concession in ROI from existing Maha Super Car loan scheme. (Subject to min floor rate RLLR-0.60%). Maha Car loan interest rates varies from 8.8% to 13% depending on the CIBIL score.
SIDBI	50KEV4ECO Initiative	50KEV4ECO is a pilot scheme under the guidance from NITI Aayog to fund MSMEs finding it difficult to access loans to purchase EVs such as two-wheelers, three-wheelers and four-wheelers for their day-to-day operations and commercial use. The mission aims to finance 50,000 EVs. Under direct lending, SIDBI extends loans to eligible MSMEs and other players in the EV ecosystem, facilitating their transition to electric vehicles and supporting the development of charging infrastructure, including battery swapping. Beneficiaries of this initiative include Aristo Securities Private Limited, Mufin Green Finance Limited, EV Motors Pvt Ltd and Techsofin Private Limited[18]

Table 6: Key Features of Green Loan Programs

2.5 Financing Challenges in EV

EV financing is primarily categorized under two underlining risks – asset risk and credit risk. Asset risk describes the risk associated with vehicle performance, maintenance, and resale value. On the other hand, credit risk illustrates the risks associated with the creditworthiness of the customer and his capacity and intent to repay.

The EV industry is new and there is a degree of skepticism both on the consumer side and the lender side on the durability and longevity of the product. The battery life of an EV is limited, and they need to be replaced periodically. Buyers have to consider the added recurring capital expenditure of battery replacement every 4-5 years with low financing options.

Also, the significantly high upfront costs driven by expensive batteries and developing battery technology leads to high interest rates. Besides, the resale value of the battery is not yet defined as a recycling market is yet-to-be established. The resale value of a vehicle without the battery is also unknown which complicate the credit risk assessment for lenders. Below are some of the key challenges associated with EV financing. .

2.6 Risks in EV Financing:

Financiers face challenges in providing competitive financing instruments to EV products due to real and perceived risks, given the nascency of the market. On the financier's side, the inability to offer competitive products stems from both real and perceived risks associated with the nascent technology and market. These include the nascent nature of EV technology, uncertain resale value of the battery / vehicle, and lack of established secondary markets.

1. **Resale Risk / Lack of Secondary Market:** The absence of a well-established secondary market for used EVs and batteries complicates the assessment of a vehicle's residual value. This uncertainty adversely affects the terms and interest rates of loans, as lenders have difficulty predicting the future worth of these assets.

2. **Technology Risk:** Many OEMs in the EV sector is relatively new with limited track records, which raises concerns about their long-term viability and the robustness of their service networks.

   Some OEMs rely on assembling imported kits, which often undergo limited quality checks. This practice can lead to concerns regarding the overall product quality and reliability.

3. **Battery Performance Risk:** The life of an EV battery, the cost associated with its replacement, and the typically limited warranty coverage compared to the vehicle's lifespan are significant concerns. These factors can deter potential buyers and financiers due to the potential for high unforeseen costs.

   Also, recurrent capital expenditures for battery replacement every 4-5 years, with minimal financing options available, increase the burden.

[17] Maha Super Green Car loan by Bank of Maharashtra
[18] De-Risking Lending for a Brisk EV Uptake, SIDBI

4. **Operational / Utilization Risk:** EVs generally achieve a better total cost of ownership (TCO) at higher utilization levels. However, there is a risk of low utilization by fleet operators, e-commerce entities, and aggregators, which can undermine the financial viability of these vehicles.
5. **Counterparty Risk:** This risk is especially pronounced in the E3W and private E-bus operator segments, where many drivers / operators are unorganized and lack a formal credit history. This lack of organization and credit documentation increases the difficulty for financial institutions to assess creditworthiness and poses a heightened risk of default.

2.6.1 Segment and use-cases wise impact

These risks and lending terms exhibit variations across different vehicle segments and end use. These variations are due to differences in the application of the vehicle and the credit profile of the buyers, as well as whether the vehicle's use is personal or commercial.

Vehicle segment	Application	Ownership
E2W	Last-mile delivery / Mobility	Individual Owner
	Last-mile delivery / Mobility	Fleet / B2B
	Personal Use	Individual Owner
E3W	Passenger mobility / Cargo	Fleet / B2B
	Passenger mobility / Cargo	Individual Owner
E4W	Personal Use	Individual Owner
	Passenger mobility	Individual Owner
	Passenger mobility	Fleet
e-bus	Passenger mobility	Individual Owner
	Passenger mobility	Fleet (STU)

Table 7: Mapping of Segment-wise Use Cases and Ownership

Here are the variations in risk perception for lending, segmented by different customer groups.

Credit Risk:

1. **Personal vs Commercial Usage:** Personal use vehicles are less risky due to stable income profiles.
2. **Credit Profile and Experience:** E-rickshaws and e-loaders have the highest credit risk due to lack of credit history and experience.
3. **Personal vs Cargo Application:** Cargo operations are riskier than passenger mobility due to variable freight demand.
4. **Individual vs Fleet Operators:** Fleet operators have better credit profiles due to their income history and experience.
5. **Startups as Fleet Operators:** Startups owning commercial e-2Ws have better credit profiles due to their structured operations.

Product Reliability:

1. **Current Adoption Levels:** EV adoption is minimal across 2Ws, 3Ws, PVs, and buses, but has grown significantly for 2Ws and 3Ws since 2019. However, financiers lack confidence in EV technology due to its low adoption.
2. **Credibility of Manufacturers:** The EV market is dominated by startups, while traditional players are cautious due to economic viability and lack of mature EV technology.
    - **e-3Ws:** Dominated by major brands like Mahindra & Mahindra, Piaggio, and Atul. Lack of charging network is a challenge.
    - **e-2Ws:** Dominated by startups like Hero Electric, Ather, and Okinawa. Financiers are hesitant to fund startups due to their short operational history.
    - **e-PVs:** Dominated by traditional players like Tata Motors, MG Motors, and Mahindra & Mahindra. Financiers have more confidence due to the presence of reputed players.
    - **E-buses:** Rapid electrification during the pandemic. Dominated by traditional players and those with a global reputation. Financiers are comfortable lending due to well-defined contracts from OEMs.

Policy Support:

1. **Subsidy as Percentage of Vehicle Cost:** The FAME II policy provides subsidies based on battery size for electric 2Ws, 3Ws, and 4Ws. E-2Ws receive the highest subsidy of 23.0%–28.0% of ex-showroom price. State-level subsidies are also provided by Delhi, Gujarat, Maharashtra, and Rajasthan.
2. **Clarity on Continuation of Subsidy:** As of 2023, subsidies have been extended till fiscal year 2024, providing comfort for EV financiers.
3. **Long-term Policy on Alternate Fuel:** The Government of India aims for 30.0% EV penetration by 2030 and promotes cleaner fuels like compressed natural gas, hybrid technology, and flex fuels.
4. Uniformity in Vehicle Registration Policy: OEMs must adhere to different rules in different regions for vehicle

registration and resale, making the resale process, especially in case of a default, cumbersome.

Business Model Risk:

1. **Business Model Risk:** This is especially relevant for commercial applications. The risk can be assessed based on vehicle utilization levels and business viability, considering the current charging infrastructure.
2. **Clarity on Utilization Levels:** Financiers gain better clarity on vehicle utilization and repayment capability in sectors with formal service contracts. However, e-3Ws operating with e-commerce companies are riskier to lend to compared to independent operators. Technological solutions like GPS are being used to overcome these challenges.
3. **Business Viability & Charging Infrastructure:** Limited availability of charging points and battery swapping stations pose a challenge, especially for e-PVs in the commercial space. Despite improvements in battery technology, the limited charging infrastructure can impact business revenue and viability. For e-2Ws, the drivable range is close to application needs, and smaller battery packs make it easier to manage charging needs.

EV industry faces unique financial challenges that hinder its growth and widespread adoption. These challenges stem from the high initial costs, nascent market structures, and lack of secondary market. To address these challenges, a multi-faceted approach involving innovative financing mechanisms, encouragement of financial institutions, and necessary policy and regulatory support is essential.

03 Electric 2-Wheeler and Electric 3-Wheeler

3.1 Market Overview

The reduction in upfront costs, increased awareness about the fuel cost savings of EVs, and continued central and state-level subsidies have fueled higher EV sales in the e-2W and e-3W segments. As a result, India's EV sales reached an impressive 40 lakhs units[19] as of March 2024, with E2W and E3W segments contributing 95% of current EV stock. [20]

3.1.1 Electric 2-Wheeler

FAME-II has been instrumental in promoting E2W adoption in India with the provision of upfront subsidies for 12 lakhs E2Ws till date. During FAME-II period (2019-24), E2W sales penetration increased from 0.2% to 5.4%.[21]

As per NITI Aayog's projections, E2W segment sales penetration is expected to 35-40% by 2030[22] . This rise in sales penetration will result into substantial increase in E2W stock, which is expected to increase from 22 lakh units currently to 251 lakh units by 2030.[23]

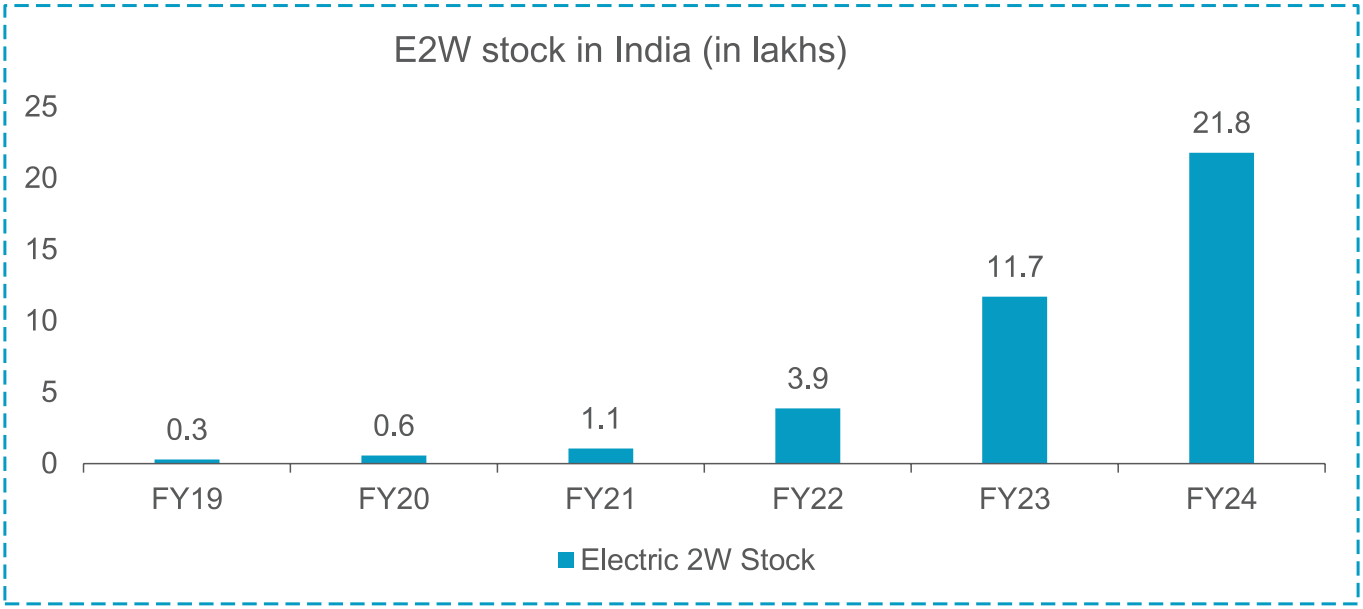

Figure 12: Historical E-2W Stock in India

E2W OEMs - Boasting over 30 manufacturers, including innovative startups challenging the status quo, the E2W ecosystem is thriving. Ola Electric, TVS Motor, and Ather dominate the market, collectively capturing over 65% of all registered electric two-wheeler sales.

Ola Electric led the market with a 30.82% share, while TVS Motors and Ather Energy held strong positions with 19.77% and 12.52% shares respectively. Traditional two-wheeler giants such as Bajaj (8.79%) and Hero MotoCorp (1.87%)[24] also maintained market shares, demonstrating their adaptability in the evolving electric mobility sector.

Challenges in adoption:

High Initial Investment: While electric scooters and motorcycles boast lower operational costs due to fuel savings, the initial purchase price still a significant deterrent, with imported lithium-ion batteries as a major cost driver.

Need for Enhanced Incentives: Government incentives help bridge the gap, but affordability remains a concern. Non-financial incentives like relaxed parking regulations[25] or priority lanes can also be impactful, fostering a more favorable environment and boosting consumer confidence in EVs.

[19] Fuel-wise 2-Wheelers Sales, Vahan Dashboard
[20] Category-wise 2-Wheelers Sales, Vahan Dashboard
[21] ICCT Report - Electric Vehicle Demand Incentives in India
[22] NITI-BCG Report - Promoting Clean Energy Usage Through Accelerated Localization of E-Mobility Value Chain
[23] GIZ-GT Analysis
[24] Maker-Wise 2-Wheelers Sales- Vahan Dashboard and JMK Analytics Report- Indian EV Market
[25] Transport & Environment, Press Release

Range Anxiety: Limited range, coupled with the lack of widespread charging infrastructure, discourages potential buyers who fear running out of power. While charging stations are expanding, they are not yet ubiquitous, particularly in smaller towns and rural areas.

3.1.2 Electric 3-Wheelers

The Indian three-wheeler market is undergoing a significant transformation towards electric vehicles in recent years. E3W market has been growing at a steady pace, with EV penetration surpassing 50% in fiscal 2023, up from approximately 10% in FY17.[26]

This growth is driven by several factors, supportive regulations that phase out traditional petrol/diesel three-wheelers and prioritize issuing new permits for EVs (like Delhi's registration cap) are accelerating the shift. Additionally, the lower operational costs associated, due to reduced fuel and maintenance expenses, make them a financially attractive choice for drivers.

E3W Segments:

Within the E3W segment, distinct categories are emerging. E-rickshaws remain the dominant force, accounting for roughly 90% of E3W volumes due to their affordability and suitability for short-distance commutes.

However, the high-speed electric 3W segment is experiencing notable growth, driven by B2B and shared mobility applications. Cargo E3Ws are another exciting development, witnessing a significant 100% year-over-year growth and increasing their market share from 3.7% to 11%.

E-rickshaws already have substantial market penetration at 54.2%, which is projected to rise to 80% by 2030. Accordingly, the EV stock is expected to grow from 16 lakh units currently to 49 lakh units[27] by 2030. This segment will be dominated by lead-acid batteries.

Meanwhile, the E3W segment (passenger & cargo) will grow from 11.9% penetration levels to 26-29% penetration by 2030[28]. This will further add 11 lakh high-speed electric 3Ws, which will run on lithium-ion batteries.

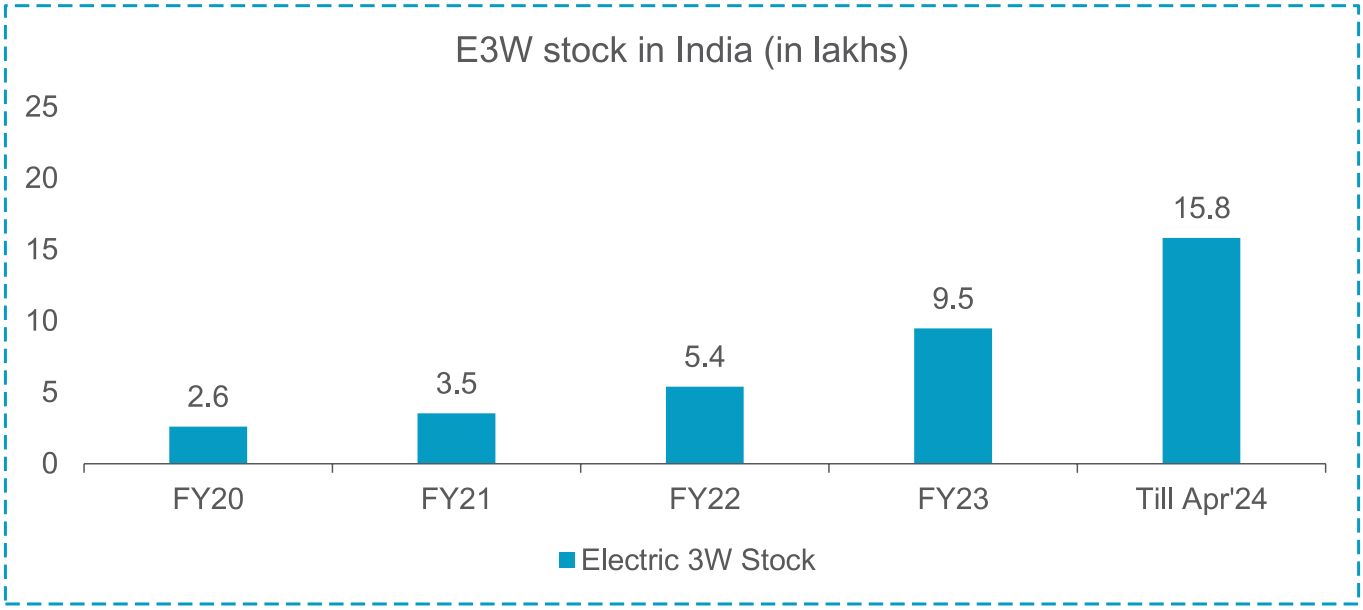

Figure 13: Historical E-3W Stock in India

Challenges in E3W adoption:

Upfront costs - A key challenge lies in the upfront cost of high speed E3Ws, which typically range between 2-4 lakhs. Lead-acid battery packs are a more affordable option compared to lithium-ion batteries, but they also offer a shorter range.

Untapped B2B potential: The fragmented ownership structure of commercial vehicles in India presents a vast opportunity for 3W EVs. However, many OEMs lack robust B2B-specific strategies to effectively engage with these customers.

There are early signs of OEMs forming B2B partnerships, however, significant potential remains unrealized. For example, Flipkart plans to transition its entire fleet entirely to EVs by 2030, and Amazon plans to introduce 10,000 EVs in its final-mile delivery fleet by 2025.

[26] Fuel-wise 3-Wheelers Sales, Vahan Dashboard
[27] GIZ-GT Analysis
[28] NITI-BCG Report - Promoting Clean Energy Usage Through Accelerated Localization of E-Mobility Value Chain

E3W OEMs:

The Indian E3W market saw a significant growth in FY24, with both passenger and cargo variants contributing to this increase.

- In the passenger E3W segment, Mahindra Last Mile Mobility, YC Electric Vehicle, and Saera Electric were the leaders, holding market shares of 8.81%, 7.35%, and 5.33% respectively.
- The cargo E3W space was dominated by Mahindra Last Mile Mobility, Piaggio Vehicles, and Omega Seiki, with market shares of 15.59%, 7.68%, and 5.42% respectively.[29]

3.2 Policy and Regulatory Support for Deployment of E2Ws in India

3.2.1 Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme

FAME scheme, launched in 2015, has been instrumental in promoting e2W adoption in India. While the initial phase (FAME I) aimed to incentivize electric vehicles in general, its impact on e2Ws was limited.

FAME witnessed a significant shift in focus with the launch of FAME II in 2019. This phase allocated a much larger budget of ₹10,000 crore (later enhanced to ₹11,500 crore) and placed a clear emphasis on promoting e2Ws[30] . A key feature was the introduction of demand incentives in the form of upfront subsidies. Initially, these subsidies were quite generous, offering ₹15,000 per kWh capped at 40% of the vehicle cost.

This significantly reduced the upfront purchase price, making e2Ws more competitive with their ICE) counterparts. However, the subsidy scheme was revised in June 2023, reducing the maximum amount to 15% of the vehicle cost.

Segment	2019-20	2020-21	2021-22	2022-23	2023-24	Total
e-2W	11.4	29.3	116.6	208.8	804.2	1170.2
e-3W	3.4	9.1	21.8	19.8	76.2	130.3

Table 8: Number of Vehicles Incentivized under Phase-II of the FAME Scheme (in '000) [31]

3.2.2 Electric Mobility Promotion Scheme (EMPS) scheme

In March, 2024, Ministry of Heavy Industries launched the Electric Mobility Promotion Scheme with a budget of Rs. 500 crore (later increased to 778 Cr.). This initiative aims to encourage the use of electric two-wheelers (e-2Ws) and three-wheelers (e-3Ws), which include e-rickshaws, e-carts, and L5 category vehicles. The scheme Launched initially for 4 months (1st April 2024 to 31st July 2024), then extended till 30th September 2024.[32]

Approximately two-thirds of the budget is allocated specifically for e-2Ws. The subsidy for e-2Ws has been reduced to Rs. 5,000 per kWh, down from Rs. 10,000 per kWh previously under FAME-II. The maximum subsidy per vehicle has been set at Rs. 10,000 for e-2Ws, a decrease from the previous 15% of the ex-showroom price. For e-rickshaws and e-carts, the subsidy is capped at Rs. 25,000, and for L5 category e-3Ws, it is capped at Rs. 50,000.

Vehicle Segment	Maximum No. of Vehicles to be Supported	Total fund support from MHI	Claims Submitted Under EMPS -2024 (No.)	Claims Submitted Amount	% fund claimed so far
e-2 wheelers	5.0 Lakhs	500 Cr.	39,635	39.61 Cr.	8%
e-Rickshaws & e-cart	14k	34 Cr.	70	0.14 Cr.	0.4%
e-3 wheelers L5	47k	235 Cr.	5,736	26.27 Cr.	11%
Total	5.61 Lakhs	769 Cr.	45,441	66.01 Cr.	8.5%

Table 9: E-Mobility Promotion Scheme in Numbers[33]

3.3 TCO Analysis for E2W and E3W segments

E2W Segment: TCO per kilometer for both conventional two-wheelers and E2Ws is lowest when they are used for commercial operations with higher daily utilization rates such as e-commerce deliveries and shared mobility.

[29] Maker-Wise 3-Wheelers Sales- Vahan Dashboard and JMK Analytics Report- Indian EV Market
[30] FAME-II Policy Document
[31] ICCT Report - Electric Vehicle Demand Incentives in India
[32] EMPS Policy Document
[33] EMPS Policy Document

a) Capex costs for EV is considered 1.5-1.8 times of ICE variant

b) Demand subsidy at 10,000 per vehicle as per EMPS scheme

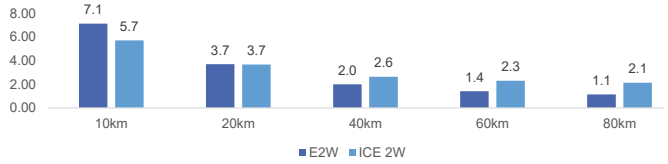

Figure 14: TCO Comparison between E-2W and ICE-2W

In E2W segment TCO parity is achieved at daily run of 20 km and above.

E3W Segment: Driving E-rickshaw is profitable due to lower costs of lead acid batteries, also e-rickshaws do not have any direct ICE counterpart. Hence, analysis is being done E3W passenger and cargo category.

a) Capex costs for EV is considered 1.4 times of ICE counterpart (CNG variant)

b) Demand subsidy at 50,000 per vehicle as per EMPS scheme.

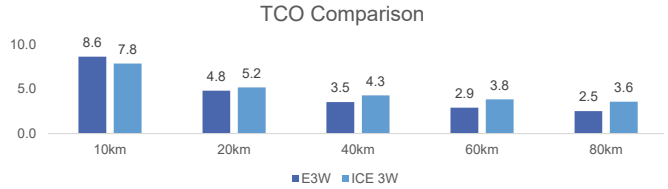

Figure 15: TCO Comparison between E-3W and ICE-3W

Total Cost of Ownership (TCO) parity is achieved for the E3W segment due to higher daily usage in ride-sharing, services, and last-mile connectivity. On the financing side, e-rickshaws have been a major success story. Many Non-Banking Financial Companies (NBFCs) fund e-rickshaws after due diligence, typically for a tenor of up to two years. MUDRA loans are also accessed for purchasing e-rickshaws, although they come with high interest rates.

Passenger E3Ws are often purchased with loans due to their high upfront cost. However, the high interest rates result in a substantial down payment for drivers. This is due to the perceived credit risk of E3W borrowers by financial institutions and technology performance related risks.

3.4 Challenges in EV Financing

a) **Technology Risk:** FIs are hesitant to finance EVs due to the lack of reliable data on their performance, including range, lifespan, maintenance needs, load capacity, etc.

b) **Battery Performance Risk:** This risk pertains to the lifespan of the battery, the associated costs of battery replacement, and the limited warranty coverage. This risk is heightened by the absence of comprehensive guarantees and potential discrepancies between the longevity of the battery and the vehicle itself.

c) **Manufacturer Risk:** The EV market is growing, but only a few EV OEMs are established and proven. Most OEMs lack historical data on product performance and service.

Additionally, FIs may not have onboarded newer OEMs on formal lending procedures. OEMs may be selling EVs at low or negative margins due to the high capital cost of EVs, creating a risk associated with their balance sheets.

d) **Resale Risk:** EVs have a reduced resale value due to the nascent ecosystem and a lack of a secondary market. This directly contributes to higher interest rates and low Loan-to-Value ratios (LTVs), as lenders find it difficult to assess the vehicle's residual value. Financiers are at risk if borrowers default, as the repossessed vehicle would be collateral for resale.

e) **Utilization Risk:** EVs are most effective at high utilisation levels due to low operations costs. For fleet operators, the utilisation of the vehicle depends on the drivers' ability to use the vehicle for a minimum run. Uncertainty and risk in these areas can reduce the FI's confidence in financing fleets.

f) **Credit Risk:** Individual drivers, particularly those driving E3Ws, often need to opt for financing due to the upfront cost of EVs. However, these drivers may not have previously borrowed from the organised sector and therefore lack a credit history that guarantees their ability to repay loans. This lack of credit history can increase the risk they represent to FIs, also FIs' lending criteria are not inclusive to first-time borrowers.

3.5 Solutions / Financing Frameworks

3.5.1 Separating Battery and Vehicle Ownership:

Stakeholders involved: Financial Institutions, Government, OEMs.

The high upfront cost of electric vehicles (EVs) is a major barrier to adoption, with battery packs accounting for a significant portion of the price tag. This translates to higher down payments and monthly loan payments (EMIs). Decoupling the battery from the vehicle purchase offers a promising solution to address this challenge and pave the way for innovative ownership models.

E2W/ E3W users encounter limited access to funding, with only a small number of banks and NBFCs willing to provide loans for EV purchases. Often, these financing terms are less favorable compared to those offered for ICE vehicles.

- The terms for available loans are less appealing; loan-to-value (LTV) ratios for EVs can be 10%-30% lower depending on the vehicle category, necessitating higher initial down payments.
- Additionally, the financial burden of EMIs is heavier due to interest rates being 1-9% higher and loan tenures being 6-18 months shorter compared to those for ICE vehicles.

	Type	Average Market Price INR	Interest	LTV Ratio	Down Payment INR	Tenure Years	Average EMI INR
	EV	135,000	17%-25%	75%	33,750	2.5-3	4,120
	ICE	100,000	12%-22%	85%-95%	10,000	3-4	2,857
	EV	425,000	18%-23%	85%-95%	76,500	3-4	11,695
	ICE	300,000	10%-22%	85%	45,000	3-5	7,226

Table 10: EMI Comparison between ICE and EV

Benefits of Decoupling:

- **Reduced upfront cost:** By separating battery ownership from the vehicle itself, the initial purchase price of the car decreases. This makes EVs more accessible to a wider range of consumers.
- **Flexible ownership options:** Decoupling enables new ownership models like battery leasing and pay-per-use schemes. Consumers can choose to lease the battery, paying only for the range they use, similar to how gasoline-powered vehicles operate with fuel costs. Battery leasing also transfers the responsibility for battery maintenance and degradation to the lessor, reducing risks for the vehicle owner.

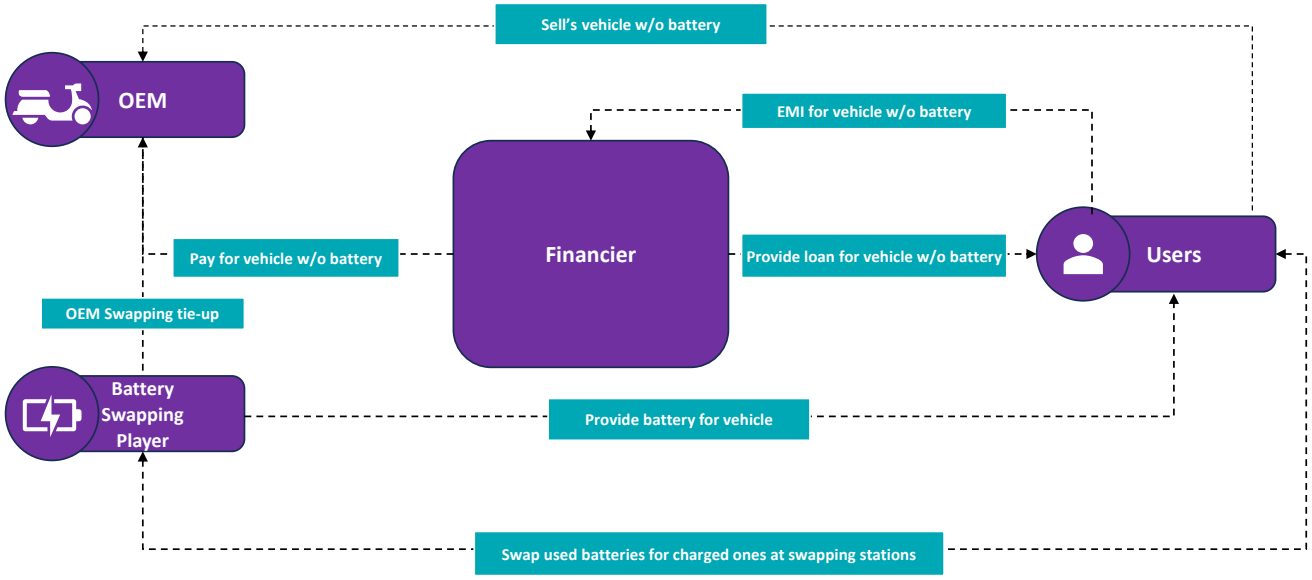

Figure 16: Battery Decoupling Model

- **Financial benefits for lenders:** De-coupling allow lenders to assess the financial risks associated with the vehicle and battery separately. This can lead to more favorable financing options for car buyers.

Enabling the Shift:

Government support is crucial to facilitate the sale of vehicles and batteries as separate entities. Here are some key areas for government intervention:

- **Rationalization of GST Rates for Lithium-Ion Batteries:** Currently, Lithium-Ion batteries are categorized under one HSN Code. The Ministry of Heavy Industry (MHI) could consider rationalizing GST rates for Li-ion batteries used in EVs based on end use, achievable through a notification by MHI.
- **Separate Registration of Vehicles Without Batteries:** To accelerate the transition to electric vehicles, especially in the 2W and 3W segments, battery swapping is crucial. However, many State RTOs do not register vehicles without batteries, forcing buyers to purchase vehicles with batteries at higher upfront costs, hindering EV penetration.
- **Inclusion of Vehicles Without Batteries Under the FAME Subsidy Scheme:** The FAME II scheme, which has significantly increased EV penetration by offering incentives for EV purchases and swapping infrastructure, does not include provisions for vehicles sold without batteries. Although the Ministry of Road Transport & Highways (MoRTH) issued an advisory in 2020 to allow registration of vehicles without batteries, the lack of government support and incentives for such vehicles has limited their sales.
- **Incentivizing Infrastructure:** Financial incentives for battery manufacturers and battery swapping station (BSS) operators are crucial. BSS operators require a higher battery-to-EV ratio compared to traditional models, so a multiplier effect in subsidies could be explored to encourage infrastructure development.

3.5.2 Risk Sharing Facilities

Implementing risk-sharing mechanisms such as Risk Sharing Facility to commercial banks for E2Ws and E3Ws can mitigate perceived financial risks. These facilities ensure that lenders have a safety net, which can spur more aggressive lending towards EV segment.

Risk-Sharing Mechanisms

By involving multiple stakeholders, including national banks, government entities, and international development organizations, these mechanisms provide a solid foundation for investments in EV and associated infrastructure.

This distribution of risk encourages banks and other financial institutions to provide loans with favorable terms, such as lower interest rates and longer tenures, which are crucial for funding EVs and associated infrastructure projects.

Mechanism

1. **Capital Provision and Incubation:**
    - **Multilateral Development Banks and Central Government:** These entities provide the initial capital to establish risk-sharing facilities. They may also participate in the incubation of these facilities to ensure their operational readiness.
    - **GEF, CTF (Funding):** They contribute by providing additional funding or guarantees, reducing the financial burden on governmental sources.
2. **Loan Loss Reserves and Guarantees:** This facility offers loan loss reserves and loan guarantees. These financial products cover potential defaults or losses on loans issued for EV charging projects, thus lowering the perceived risk for lenders.

Figure 17: Risk Sharing Facility

3. **Engagement with Financial Institutions:**

    - **Banks and NBFCs:** With the back-up of risk-sharing mechanisms, these institutions can afford to offer loans with reduced interest rates and extended repayment periods, making financing more accessible to project developers.

4. **Advisory and Design Consultation:**

    - **Development banks, Think Tanks:** These bodies provide expertise in the design and terms of the risk-sharing facilities, ensuring that they align with national priorities for EV adoption and infrastructure development.

Benefits of Risk-Sharing Mechanisms

- Minimizes Losses for Financial Institutions: Reduces potential losses in case of a default, encouraging financial institutions to be less risk-averse.
- Prioritization of Critical Segments: Enables prioritization of more critical vehicle segments such as 2W/3Ws, and critical applications like ride-sharing and delivery.
- Enhanced Financing Availability: By mitigating lender risks, these mechanisms increase the availability of credit for potentially high-risk ventures in the EV sector.
- Lower Cost of Capital: Financial backing from risk-sharing mechanisms results in lower costs of borrowing, making large-scale investments more feasible.

3.5.3 Reduce EMI Burden and Enhance Electric Vehicle Adoption:

Subvention Schemes: Subvention schemes can be strategically designed to alleviate a portion of the customer's interest burden by leveraging various stakeholders within the EV ecosystem. These schemes can be implemented through the following mechanisms:

- **Direct Government Intervention:** The government can directly offer interest subventions to EV buyers. A centralized platform managed by a government entity, such as Convergence Energy Service Ltd (CESL), can streamline the process by connecting OEMs, financiers, and customers. This platform would showcase eligible EV models with corresponding loan quotes from participating banks and NBFCs. The government would then provide subventions directly to the financiers, effectively reducing the interest rates borne by the customer.
- **Multilateral Development Bank (MDB) Participation:** MDBs can collaborate with banks and NBFCs to offer EV loans with mandated subventions compared to traditional internal combustion engine (ICE) vehicle loans. This strategy mirrors successful partnerships like CEFC's program in Australia, fostering a more attractive financing landscape for EVs.
- **OEM-Driven Subvention Programs:** Original Equipment Manufacturers (OEMs) can design subvention schemes through their dealerships. These schemes can be backed by risk sharing funds to mitigate potential non-performing assets (NPAs) and product losses. However, such initiatives would need to be spearheaded by OEMs themselves, rather than being mandated through regulation.

3.5.4 Financing Innovation:

- **Subsidized Loan Programs:** Programs akin to the Delhi EV Policy's 5% interest rate subvention on loans for electric autos[34] can be adapted for 2-wheeler EVs. Partnerships between state governments, banks, and NBFCs can significantly enhance the affordability of financing electric 2-wheelers.
- **State-Specific Loan Initiatives:** The Kerala Finance Corporation's low-interest loan program can serve as a blueprint for replication in other states. Offering loans with competitive interest rates, extended repayment terms, and minimal down payments can incentivize the purchase of EVs.
- **Alternative Risk Assessment:** While credit score requirements are crucial, considering alternative methods like salary slips and employment verification can expand the pool of eligible borrowers for EV loans.
- **Inclusive Vehicle Coverage:** Current programs have limitations on the types of vehicles they cover. Ensuring all registered EV forms, encompassing both private and commercial use cases, are eligible for financing schemes will broaden their reach.

[34] Delhi EV Policy Document

04 Chapter 4 Electric Buses

4.1 Market Overview

TheThe electric bus market in India is an emerging segment with significant growth potential driven by government initiatives to decarbonize public transportation and retire aging diesel buses. Currently, the market is in its nascent stage, with limited penetration and fewer electric bus models available compared to internal combustion engine (ICE) counterparts.

Adoption has been primarily driven by state governments and State Road Transportation Corporations (SRTCs). As on May 31, 2024, around 8300 electric buses were in operation, with major players such as Tata Motors, Olectra, JBM, and Foton PMI, collectively holding over 80% market share.[35]

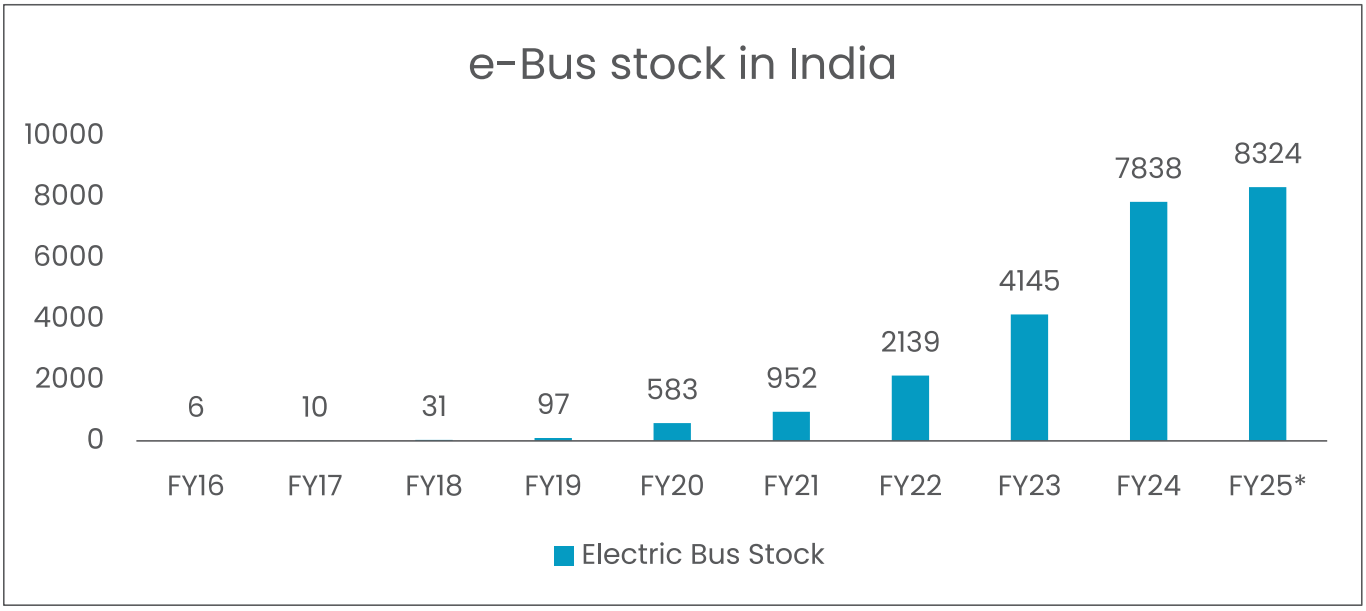

Figure 18: Historical E-Bus Stock

States like Delhi, Maharashtra, Karnataka, Gujarat, and Uttar Pradesh constitute about 80% of the electric buses in India. Delhi has the highest % share of electric buses from the total EV penetration in the states.

Tata Motors led the market with a 47.20% share, while Olectra Greentech and PMI Foton held strong positions with 15.82% and 10.42% shares respectively. Other automotive manufacturers such as JBM Auto (9.30%) and Mytrah Mobility (6.25%)[36] also maintained considerable market shares.

STU led Model for E-buses in India

The electric bus market in India is characterized by a strong disparity in capital expenditure between EV and ICE variants. Presently, e-buses cost approximately at 1.5-2 times higher than diesel counterparts, depending on specifications. Traditionally, buses in India have been procured through outright purchase, but the higher cost of e-buses presents a challenge.

Under the FAME II scheme, electric buses received the highest financial support on a per-kWh battery capacity basis, with ₹20,000 per kWh. However, only electric buses used for public transport by government or municipal corporations were eligible for these incentives.

The FAME II scheme mandated the use of the Gross Cost Contract (GCC) model for deploying electric buses. In this model, while the government transit authority manages the transit system, a contracted private entity owns, operates, and maintains the buses. STU makes periodic payments to the private entity on a per kilometer basis throughout the contract's life.

The GCC model allows for a more even distribution of cash flows across the contract's life, facilitating better matching of revenue and expenses. It also helps distribute the risk associated with deploying e-buses between the government transit authority and the private operator.

[35] Delhi EV Policy Document Maker-Wise Bus Sales- Vahan Dashboard and JMK Analytics Report- Indian EV Market
[36] Maker-Wise Bus Sales- Vahan Dashboard and JMK Analytics Report- Indian EV Market

Lower Adoption in Private Sector: While the current market is dominated by public sector procurement due to the availability of FAME subsidies, electrification of the private sector bus fleet is crucial to accelerate adoption and achieve pollution control and climate goals.

However, challenges persist, such as high initial costs compared to diesel counterparts, range anxiety, limited model availability, varying duty cycles across segments, and dependence on imported lithium-ion battery cells impacted by inflation and currency fluctuations.

4.2 Policy and Regulatory Support for Deployment of Electric Buses in India

Indian government plan to replace 800,000 diesel buses, constituting approximately one-third of the total bus fleet on roads, with electric buses over the next seven years. The replacement strategy involves deploying 200,000 electric buses for state transport undertakings (STUs), 550,000 for private operators, and 50,000 for schools and employee transportation by 2030. However, the current market is heavily reliant on public sector procurement due to the availability of FAME subsidies only under the gross cost contract (GCC) model.

4.2.1 Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme

Launched in 2015, FAME scheme aimed to incentivize the purchase of e-buses by offering subsidies to state transport corporations. However, the high cost of e-buses compared to diesel ones, coupled with funding challenges faced by many state corporations, hindered the scheme's effectiveness initially. Additionally, a lack of technical expertise in maintaining and operating electric buses posed further obstacles.

In the first phase of FAME, buses were procured using various models, including Outright Purchase Model (OPM), Gross Cost Contract Model (GCC), and Net Cost Contract Model (NCC). The majority, 74% of the total bus order quantity, was purchased through the Outright Purchase Model or CAPEX Model.

To address the challenges faced in FAME I, the second phase of FAME introduced the Gross Cost Contract (GCC) model, which shifted the burden of operating and maintaining e-buses to private players. Instead of outright purchases, state transport corporations paid original equipment manufacturers or e-bus operators a per km cost for operations and maintenance. This model mitigated the risk associated with new technologies for the state transport corporations.

A snapshot of FAME scheme is as below –

		FAME I (2015-2019)			FAME II (2019-2024)		
1	**Funds**	Budget	795 Cr. (all segments)		Budget	3545 Cr. / 7090 e-buses	
		Utilized	529 Cr. (all segments)		Utilized	Not Available	
2	**Subsidy Criteria**	Level of Localization			Bus Length		
3	**Subsidy Amount**	% localization achieved	Subsidy (maximum)		Standard Bus (10M < L ≤ 12 M)	55 Lakhs	
		Minimum 15%	Minimum of 60% of purchase cost and 85 Lakhs		Midi Bus (8M < L ≤ 10 M)	45 Lakhs	
		Minimum 35%	Minimum of 60% of purchase cost and 1 Crore		Min Bus (6M < L ≤ 8 M)	35 Lakhs	
4	**Type of Bus Supported**	Both Hybrid and Electric Buses			Electric Buses		
5	**No. of E-Bus Supported**	425			6862 (Sanctioned as of Dec. 23[37])		
6	**Business Model**	Outright Purchase, GCC, NCC			GCC, Utility led variant of GCC		

Table 11: Snapshot of the FAME Incentives for e-buses

[37] PIB Press Release on Number of E-Buses supported under FAME-II

4.2.2 CESL Grand Challenge (2021)

The CESL Grand Challenge for Electric Buses, launched in 2021, aimed to speed up electric bus deployment in India by addressing affordability and demand aggregation challenges. CESL facilitated demand aggregation by coordinating with state transport corporations and municipal authorities.

In its initial phase, CESL awarded contracts for 5,450 electric buses to major cities like Bengaluru, Delhi, Hyderabad, Surat, and Ahmedabad. The success of the initiative has led to further consideration of consolidated procurement, with CESL aiming to procure an additional 50,000 e-buses over the next five years[38]

4.2.3 National Electric Bus Programme (2022)

To improve and encourage a clean fuel based public transport, National Electric Bus Program (NEBP) was introduced in 2022. This program envisages the deployment of 50,000 electric buses across the country till 2027 in addition to buses deployed under FAME II[39]. The program is a unique model where the electric buses demand of various cities across the country is aggregated, and the tender conditions and the bus specifications are homogenized across the cities to get the benefit of economies of scale.

In 2022, CESL conducted the first procurement of 6,465 e-buses under the NEBP on GCC model. The lowest discovered price for a 12-meter intra-city bus was Rs. 54.3/km, while for inter-city, it was Rs. 39.8/km. For a 9-meter bus, the price was Rs. 54.46/km, and for a 7-meter bus, it stood at Rs. 61.92/km.

4.2.4 PM E-Bus Sewa (2023)

The scheme was launched to enhance bus operations by deploying 10,000 electric buses through a public-private partnership (PPP) model, with central assistance amounting to ₹20,000 crores. This scheme aims to support green urban mobility initiatives, complementing bus services and demonstrating a reduction in greenhouse gas emissions in urban areas. Besides deploying e-buses, the initiative includes upgrading depot infrastructure and creating essential behind-the-meter power infrastructure, such as substations, to support the electric buses.

The scheme targets cities with populations of three lakhs and above, whereas the FAME II initiative focused on deploying e-buses in nine cities with populations exceeding four million. The scheme will be implemented in two segments: deploying 10,000 e-buses in 169 cities using the PPP model and upgrading infrastructure in 181 other cities under the green urban mobility initiative. CESL is conducting procurement for electric buses under this scheme with ggregated demand.

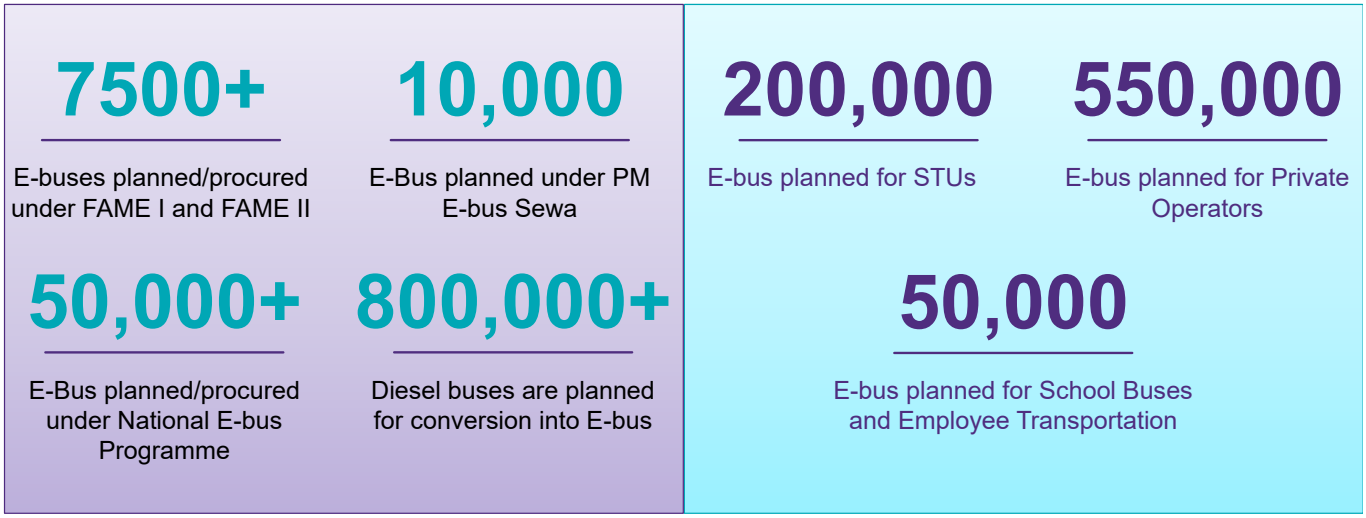

Figure 19: Figure 18: PM E-Bus Sewa Scheme in Numbers

[38] CESL Grand Challenge EoI Document
[39] Sansad Document on Deployment of Electric Buses

4.3 TCO Analysis

State Road Transport Undertakings have been early adopters of e-buses in India. The incentives provided by the governments have made their transition plans easier. By reducing upfront costs through incentives, leveraging market forces, and extending the holding periods of these vehicles, state-owned corporations can achieve financial sustainability much quicker.

The below table provides a Total Cost of Ownership (TCO) analysis in Rs/km for different bus segments. E-buses, especially with the FAME subsidy, have a lower TCO compared to diesel buses.

E-Bus Segment	Diesel Bus	E-Bus (Without FAME Subsidy)	E-Bus (With FAME Subsidy)
12-mtr std High end	78.57	77.75	65.90
12-mtr std Low end	61.14	53.57	47.85
9-mtr std High end	61.78	63.11	54.58
9-mtr std Low end	50.09	49.44	44.61

As per WRI Analysis

Table 12: TCO Comparison for Diesel and E-Buses (in INR/km)

In contrast to diesel buses, the operational cost of electric buses (e-buses) decreases with higher vehicle utilization. This means that the more e-buses are used, the lower the cost per kilometer. However, financing costs remain a crucial barrier to the TCO of e-buses.

Debt finance requirements make it challenging for operators to purchase e-bus fleets. Operators must provide 25% equity, while the remaining 75% requires bank guarantees and collateral, with associated fees of 0.5%–1.5%.

High interest rates and stringent loan conditions further complicate investments in e-buses, despite their long-term cost benefits. Addressing these financing challenges is crucial to fully realize the economic advantages of e-buses over traditional diesel buses. Addressing these financing challenges is essential to fully realize the economic advantages of e-buses over traditional diesel buses.

4.4 Financing Challenges for E-Bus Adoption in India

4.4.1 Inadequate Battery Warranty

One of the paramount challenges hindering financial institutions from providing favorable financing for electric buses in India is the inadequate warranty coverage offered for the battery packs. These battery systems constitute a substantial portion of the overall vehicle cost, accounting for approximately 40% of the total expenses.

The expected lifespan of electric buses is typically over 10 years. However, the usable life of most bus batteries is only around 6-7 years, significantly shorter than the vehicle itself. This discrepancy raises concerns regarding battery degradation and the substantial replacement costs operators may face during the operational lifetime of the buses. Compounding the issue, the warranty coverage provided by original equipment manufacturers (OEMs) is limited, ranging from just 4-6 years or 2-4 lakh kilometers, whichever comes first. These short warranty periods fail to adequately cover the expected lifespan of the buses, leaving operators vulnerable to significant unforeseen expenses for battery replacements.

The residual value of electric buses becomes uncertain without comprehensive and extended battery warranties. This poses a risk for financial institutions in terms of asset valuation and recovery, as the resale value of buses with degraded or near-end-of-life batteries could be substantially lower than anticipated. Moreover, frequent battery replacements can lead to operational downtime and additional maintenance costs, disrupting revenue streams and potentially impacting the ability of operators to meet their financial obligations, thereby increasing the risk for lenders.

Resolving the inadequate battery warranty issue is pivotal for the widespread adoption of electric buses in India, as it directly impacts the overall cost-effectiveness, operational feasibility, and risk perception associated with these vehicles.

Challenges of Inadequate Battery Warranty in Financing Electric Buses

Figure 20: Inadequate Battery Warranty - Underlying Factors

4.4.2 Financial Leverage Risks

The current financing model for electric buses under the FAME-II scheme pose a significant barrier to the large-scale adoption of electric buses in India due to the financial leverage risks for Original Equipment Manufacturers (OEMs). The eligibility criteria require OEMs or OEM-led consortiums to be the bidders for the tenders or have prior agreements with operators. As a result, OEMs are compelled to form special purpose vehicles (SPVs) such as subsidiaries and joint ventures to act as leasing companies for owning, operating, and recovering payments from State Transport Undertakings (STUs). Notable examples of such OEM-backed SPVs include Olectra-BYD and Foton-PMI.

For these OEM-backed SPVs, one of the primary challenges is the debt finance requirements, which mandate a 25% equity contribution, while the remaining 75% must be backed by bank guarantees and collateral, with fees ranging from 0.5% to 1.5%. This deleverages process ties up the SPVs' balance sheets, hindering their ability to participate effectively in future tenders.

Financing Institutions often demand collateral on the debt portion, further leveraging the OEMs' balance sheets. Additionally, delayed payments from State Transport Undertakings (STUs) exacerbate cash flow challenges, compounding the financial burden on OEMs. Beyond cash flow concerns, OEMs are required to hold electric buses on their balance sheets and source capital to finance them. This can also impede their ability to meet their strategic objectives, as their core business is manufacturing vehicles rather than operating buses.

4.4.3 Delayed Payments:

State Transport Undertakings (STUs) in India face significant financial challenges, leading to delayed payments to electric bus operators. The primary source of revenue for most STUs is fare collection, which is insufficient to cover their expenses, resulting in persistent losses. This financial instability exacerbates counterparty risk for Original Equipment Manufacturers (OEMs), making them hesitant to engage in contracts.

One of the primary reasons for the delayed payments is the limited financial resources available to STUs. Many STUs are grappling with financial constraints due to factors such as rising operational costs, aging fleets, and inefficient management practices[40]. The poor financial health of STUs affects their ability to pay operators on time under Gross Cost Contracts (GCC), jeopardizing the operators' financial stability and making it difficult to sustain electric bus operations. Consequently, the project's bankability is reduced, increasing costs for operators to raise capital and deploy e-buses, thus limiting participation in e-bus tenders. Additionally, changes in model contract terms by various authorities, such as relaxing payment default clauses, further impact the financial viability of these projects, deterring potential bidders.

[40] MoRTH Report on Review of Performance of State Transport Undertakings

The impact of delayed payments on electric bus service providers is multifaceted and can have far-reaching consequences:

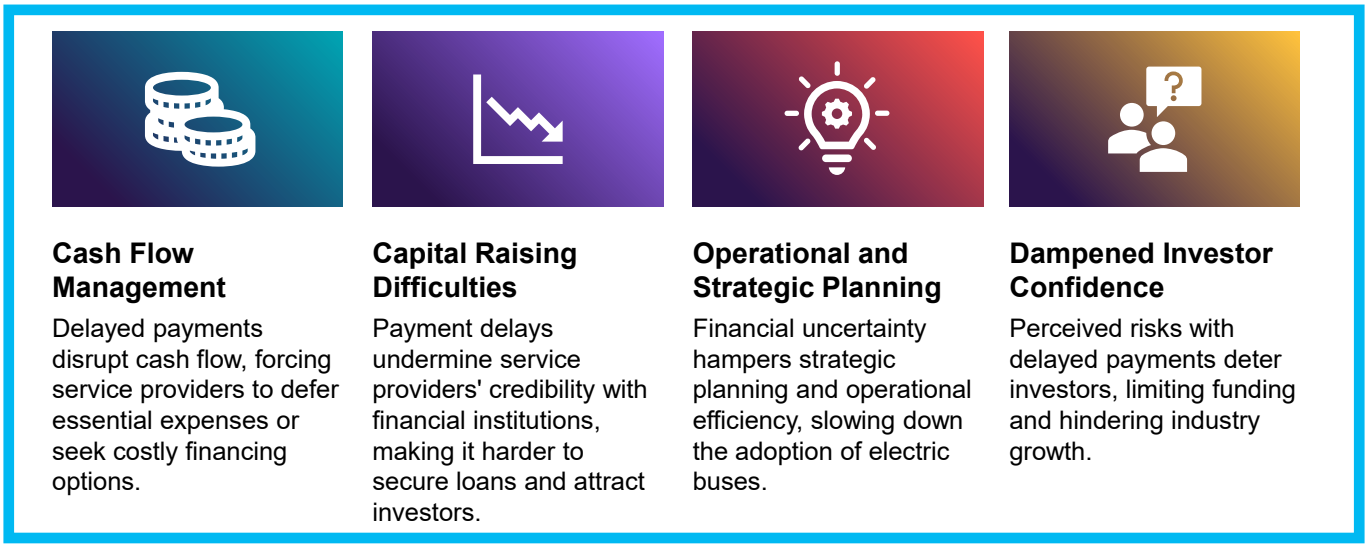

Figure 21: Consequences of Delayed Payments to E-Bus Service Providers

4.4.4 Contractual Bankability

Contractual bankability poses a major obstacle to the deployment of electric buses in India due to various perceived risks in contracts with State Transport Undertakings (STUs). Aside from payment security, one of the main concerns is revenue risk. The revenue model for electric bus operations depends heavily on factors such as ridership, fare structures, and operational efficiency, making revenue projections uncertain. Investors and OEMs perceive risks in these projections, especially when demand for public transportation fluctuates or fare adjustments require regulatory approval. They require robust demand studies and mechanisms to mitigate these revenue risks.

Figure 22: Concerns related to Contractual Bankability

Additionally, high fixed expenses, such as capital costs, bank guarantees, maintenance, and charging infrastructure, along with the potential for unbalanced penalties and the risk premium associated with delayed payments, contribute to higher Gross Cost Contract (GCC) rates and reduced project bankability. The low bankability of electric bus leasing contracts makes these projects high-risk and less attractive to financiers. OEMs and fleet operators face significant challenges in accessing market financing due to uncertainties about assured returns on loans. The long-term nature of electric bus projects necessitates robust and enforceable contracts to ensure sustained investment and operational commitments from all parties involved.

4.4.5 High Capital Costs:

The widespread adoption of electric buses in India faces a significant challenge: the high upfront capital cost. Electric buses can be priced at a premium of 1.5 to 2 times that of their diesel counterparts, creating a substantial financial burden for public transportation operators, many of whom are already grappling with existing debt. Securing financing for e-buses is often more challenging due to stricter loan terms, higher down payments, and the uncertainty surrounding the resale value of this new technology. The additional capital expenditure (Capex) required for frequent battery replacements (every 4-5 years) further adds to the

overall cost of ownership. The unpredictable future costs associated with battery replacement due to evolving technology and fluctuating raw material prices introduce another layer of complexity.

Furthermore, the high upfront cost necessitates significant debt financing (around 70% for tenders), exacerbating the financial burden for operators. This is compounded by the current revenue structure, which is based on kilometers run, creating a cash flow risk since operators have limited control over actual bus utilization. These factors combine to make the initial investment in electric buses potentially prohibitive for public transportation operators, whose widespread adoption is critical for the success of e-bus implementation in India.

4.4.6 Absence of Secondary Market

The absence of a well-developed secondary market for electric buses in India poses a significant barrier to their widespread adoption. Traditionally, operators sell internal combustion engine (ICE) buses or their auto parts in the secondary market for tourist and airport services after approximately ten years of usage on public transport routes. This established practice enables operators to recover a portion of their investment, facilitating fleet upgrades and maintaining financial viability. However, for electric buses, there is significant uncertainty regarding their residual value, lifespan, and potential secondary market applications, including second-life use cases for both vehicles and batteries.

The adoption of electric vehicles (EVs) in India has gained momentum only recently, and most electric vehicles sold to date have not yet completed their product lifecycle to enter the used market. Consequently, the secondary market for EVs, including electric buses, remains nascent and underdeveloped. This nascent stage of the secondary market creates several challenges. Fleet operators face limited resale value and significant financial risk without a reliable platform to sell used electric buses, making the initial investment less attractive. The lack of a robust secondary market also hampers fleet upgradation efforts and restricts access to smaller operators who might otherwise benefit from purchasing used electric buses at lower costs. Furthermore, the absence of a secondary market limits financing options, as financial institutions are hesitant to offer favorable terms without clear asset recovery mechanisms.

4.5 Solutions / Financing Frameworks

4.5.1 Decoupling Battery and Vehicle Financing:

Aligning with global trends, India can significantly accelerate the deployment of electric buses (e-buses) by adopting a strategy of separating battery and vehicle financing. This approach can unlock new financing avenues specifically tailored to battery procurement, enhancing overall investment attractiveness, and easing the financial burdens on e-bus operators. Our consultations suggest this can reduce capital expenditure by 40%, making it a highly attractive option.

Benefits of Separate Financing for E-Bus Deployment

- **Reduced Upfront Costs** – By offering separate loans for the bus chassis and the battery pack, the upfront costs for operators can be significantly lowered. This is crucial as the battery typically constitutes the majority of an e-bus's cost, driving up both down payments and Equated Monthly Installments (EMIs).
- **Risk Differentiation** – Financiers can assess and factor in risks for the vehicle and battery separately. This risk differentiation allows for standalone lending options for the vehicle and the battery, reducing the overall loan amount required for the vehicle itself. Consequently, this lowers the down payment and EMIs, making e-bus ownership more accessible.
- **Expense Management** – Operators have the opportunity to manage expenses related to the battery as per usage, similar to how fuel costs are managed for Internal Combustion Engine (ICE) vehicles. This user-based expense model can make the financial profile of e-buses more predictable and manageable for operators.
- **Battery Maintenance and Risk Transfer** – Implementing models like battery leasing can transfer the risk of battery maintenance from the operator to the lessor. This not only reduces the maintenance burden on operators but also ensures that batteries are maintained at optimal performance levels.

Model 1 - Financial leasing, separation of vehicle and battery, battery as a service –

This model proposes a financial leasing solution to increase electric bus (e-bus) adoption in India by decoupling battery and vehicle financing. By treating the battery as a separate financial product, this approach significantly reduces upfront costs for bus operators, unlocks new financing avenues, and streamlines expense management, paving the way for a more accessible and attractive e-bus market.

- **Vehicle Purchase:** Bus operators acquire the e-bus chassis from the manufacturer, minus the battery. This significantly reduces the initial capital outlay required compared to purchasing a complete e-bus with the battery included. The bus operator receives the e-bus and technical support from the bus provider.

- **Battery Leasing** – Bus Operators lease the battery from a third-party lessor, typically a financial institution, which acquires the battery from the battery manufacturers. The bus operator signs a (battery) leasing contract with the leasing company. They pay a regular lease fee which covers the cost of the battery, financing, and maintenance.
- **Maintenance and Upgrades:** The lessor is responsible for battery maintenance and upgrades throughout the lease term. This ensures that operators consistently have access to high-performance batteries without the burden of maintenance costs or the risks associated with battery degradation.

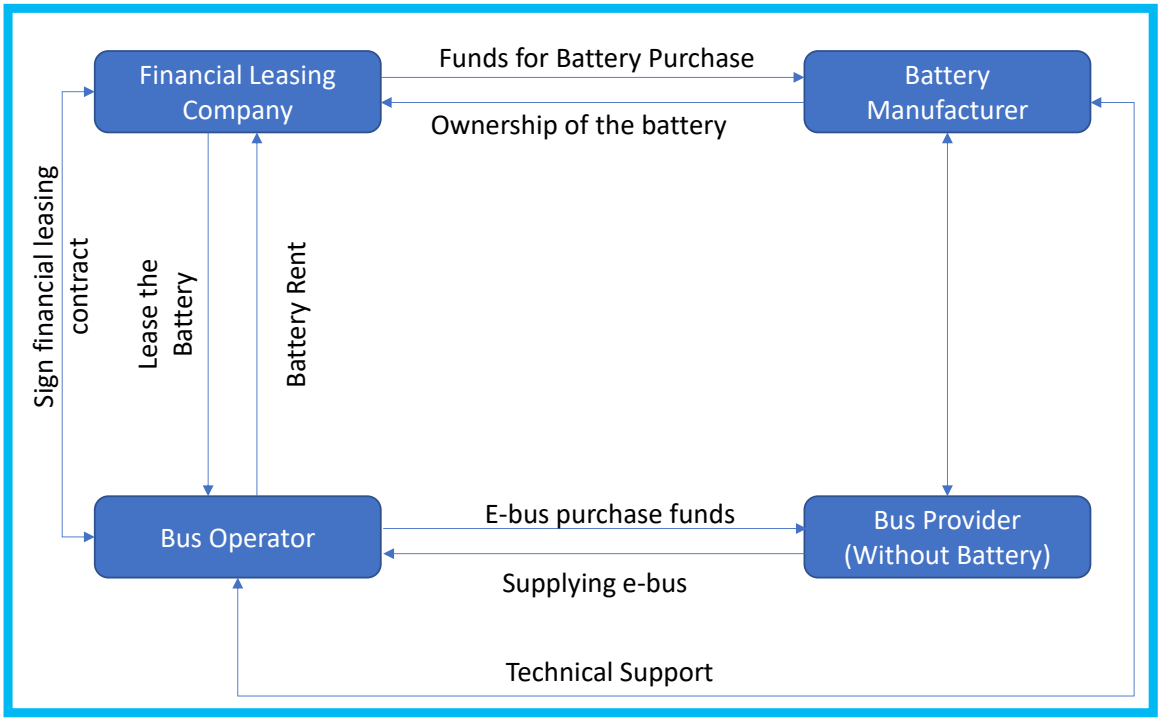

Figure 23: Financial leasing Model for E – Buses – Separation of vehicle and battery, battery as a service

Model 2 - Battery Swapping Model (Optional)

In a battery swapping model, leasing company will enable battery OEMs to sell swappable batteries so customers can purchase vehicles without batteries. In addition to the modalities above, battery swapping is done at designated battery swapping stations to minimize the downtime and maximize operational efficiency. When a battery's charge is depleted, the operator can swap it for a fully charged one at a designated station.

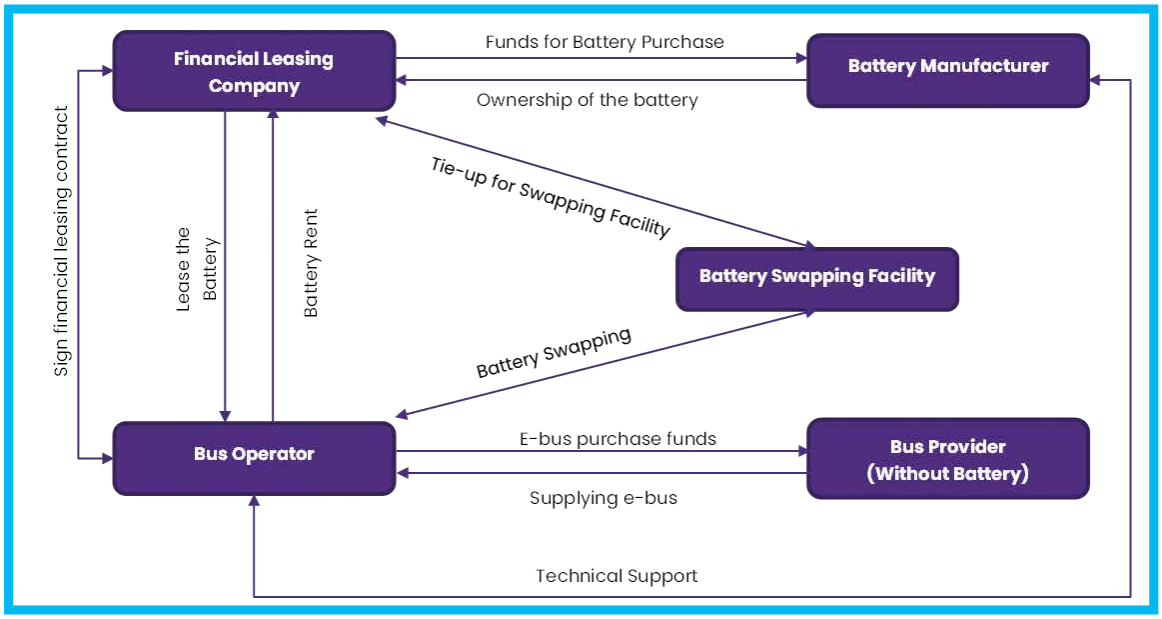

Figure 24: Battery Swapping Model for E – Buses

4.5.2 Payment Security Mechanism

The adoption of electric buses in India is a critical step towards achieving sustainable and eco-friendly public transportation. However, the transition from traditional buses to electric buses faces several challenges, including financial risks and the bankability of e-bus contracts with State Transport Undertakings (STUs). A critical solution lies in the development and implementation of a robust Payment Security Mechanism (PSM). This mechanism will mitigate the risk of delayed payments, improve bankability of e-bus contracts, and ultimately accelerate e-bus penetration across the country.

Therefore, for programs with no-subsidy provisions for e-buses like PM E-Bus Sewa and the National E-Bus Programme, implementing a robust PSM is essential to enhance the bankability of e-bus contracts with STUs and to accelerate the deployment of e-buses across the country.

To address these challenges, PSM framework similar to the Solar Energy Corporation of India's (SECI) model for solar projects is proposed. This framework aims to ensure financial stability and attract investment by providing payment guarantees.

- **Establishment of a National-level Payment Security Fund:** A central fund should be established to provide guarantees for e-bus contracts. This fund would be used to ensure timely payments to operators in case of delays by STUs. The fund will act as a guarantor, mitigating the risk of payment delays and enhancing the bankability of e-bus contracts.
- **Direct Debit Mandate (DDM) with RBI:** Participating states should sign a DDM with the Reserve Bank of India (RBI). Under this mandate, if a STU fails to recoup the Payment Security Fund within 90 days, the necessary funds would be directly debited from the state's accounts by the RBI. This mechanism ensures the fund's replenishment, maintaining its financial health.
- **Coverage Period:** The PSM should cover up to 12 years for each e-bus deployed under the scheme, aligning with the typical contract duration and the operational lifespan of the buses. This coverage period will provide financial stability and confidence to operators and investors, encouraging them to participate in the e-bus procurement process.
- **State Participation and Accountability:** States participating in the e-bus program must commit to the PSM, ensuring that STUs under their jurisdiction adhere to the financial and operational standards required. This commitment can be formalized through agreements between the states and the central government.
- Bankability and Financial Assurance: The PSM provides financial assurance to OEMs and operators, enhancing the bankability of e-bus projects. With guaranteed payments, financial institutions will be more confident in extending loans and investments, thus facilitating the procurement and deployment of e-buses.

PSM was introduced during Interim Budget 2024. The United States and India announced plans to create a payment security mechanism that will facilitate the deployment of 10,000 Made-in-India electric buses in India, in 2023.

With contributions of $240 million from the Government of India and $150 million from the US government and their partners, the establishment of the PSM would guarantee delayed payments from the fiscally constrained state bus companies. PSM aims to unlock up to $10 billion in non-recourse lending to e-bus manufacturers in India to deploy 38,000 buses.

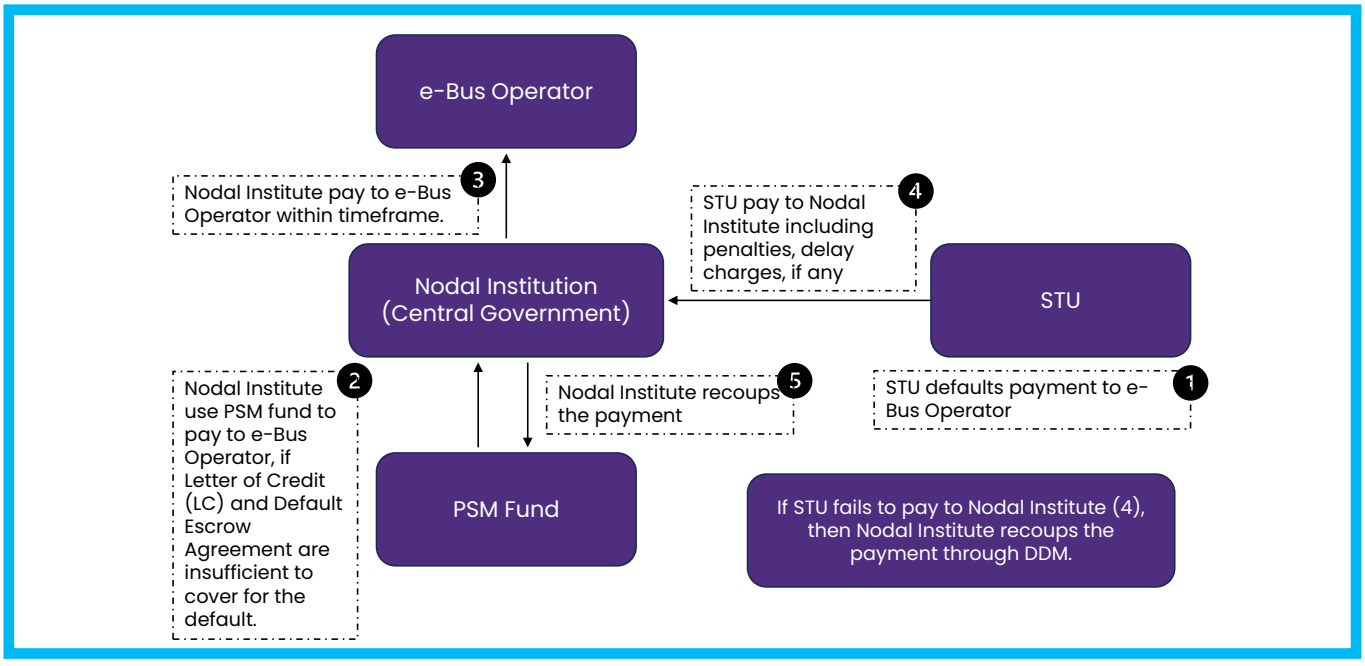

Figure 25: Payment Security Mechanism Model

Benefits of a Robust PSM:

- **Reduced Risk for Operators:** Timely payments ensure financial stability for e-bus operators, allowing them to focus on efficient service delivery. This fosters a more competitive bidding environment, potentially leading to lower per-kilometer fares.
- **Increased Investment:** With a reliable payment guarantee, e-bus contracts become more attractive to Fis. This facilitates easier access to loans for operators, easing the upfront financial burden.
- **Improved OEM Confidence:** The PSM mitigates the risk associated with weak creditworthiness of PTAs. This incentivizes OEMs to participate in e-bus tenders, leading to a wider pool of qualified manufacturers.
- **Operational Stability:** With assured financial flows, operators can focus on maintaining high-quality and sustainable e-bus services, contributing to the long-term success of the program.
- **Boost for E-Bus Adoption:** A robust PSM creates a win-win situation for all stakeholders. Operators can operate with greater financial security, OEMs have a more predictable market, and ultimately, India accelerates its transition towards a cleaner and more sustainable public transport system.

A well-designed Payment Security Mechanism is crucial for accelerating the adoption of electric buses in India. By mitigating financial risks and ensuring timely payments, the PSM framework can boost investor confidence, attract necessary funding, and facilitate the deployment of sustainable public transportation solutions.

4.5.3 Priority Sector Lending for Electric Buses

A pragmatic solution lies with India's apex bank, the Reserve Bank of India (RBI), designating electric buses under the 'social infrastructure' category of Priority Sector Lending (PSL). The PSL policy mandates banks to lend a specified portion of their funds to underserved sectors that can aid the nation's economic and social development. Inclusion of electric buses would incentivize banks to offer affordable credit with lower interest rates to public transport operators facing high upfront capital costs of e-bus procurement. This would provide a much-needed financial impetus to accelerate e-bus adoption across the country. However, PSL status needs to be complemented with concurrent initiatives focusing on reducing risks associated with EVs, such as product warranties, risk-sharing mechanisms, and developing a secondary market for used e-buses.

These measures would increase banks' confidence in lending to the sector. Moreover, introducing an EV-specific PSL target with internal lending limits based on the economic life of vehicles, akin to existing renewable energy PSL guidelines, can maximize the intervention's benefits. Public sector banks and industry bodies have already advocated granting PSL recognition to retail EV financing, underscoring the pragmatic potential of this solution leveraging the existing policy framework.

4.5.4 Interest Subvention with Risk Sharing Facility

The Government of India has already incentivized electric vehicles including e-buses by exempting road tax and waiving toll plaza fees. While these measures are significant, a comprehensive approach that includes targeted financial incentives can further accelerate the adoption of e-buses. In this context, an interest subvention scheme emerges as a viable and effective solution.

Interest subvention involves offering loans at subsidized interest rates to facilitate the acquisition of e-buses. To support the adoption of e-buses by private stage carriage operators—an essential segment of India's affordable public transport system—the lower interest rates, say 4-6%, with a tenure of up to seven years may be provided.

This can be implemented through green financing mechanisms, leveraging funds from multilateral development institutions and banks. By channeling resources from these avenues, the government can minimize the immediate fiscal impact on the exchequer while promoting sustainable urban transportation solutions.

Furthermore, coupling interest subvention with a risk sharing facility will provide an added layer of financial security. A risk sharing facility involves the government and financial institutions sharing the risk of loan defaults, thereby encouraging banks to offer loans to e-bus operators with greater confidence.

A structured approach combining interest subvention with a risk sharing facility will provide the following benefits:

- **Cost Efficiency:** By lowering the interest rates on loans for e-bus procurement, the initial financial burden on operators is significantly reduced, making the transition to electric buses more economically feasible.
- **Extended Support:** A longer loan tenure, say seven years, aligned with the operational lifespan of e-buses can ensure that operators have sufficient time to achieve a return on investment while maintaining affordable fare structures for the public.
- **Risk Mitigation:** The risk sharing facility will reduce the perceived financial risk for banks, encouraging them to extend loans to a broader range of operators, including those with limited credit history or smaller balance sheets.

- **Encouraging Private Participation:** Interest subvention, coupled with risk sharing, will incentivize private operators to invest in e-buses, thereby expanding the reach and impact of electric public transportation.
- **Market Stability:** The risk sharing facility provides a safety net that helps stabilize the market, ensuring sustained growth and reducing the likelihood of financial distress among operators.]

These incentives can be gradually phased out as the market for e-buses matures and operations become viable for private operators. This phased approach will foster a robust and competitive market environment, encouraging innovation and cost reduction in the long term.

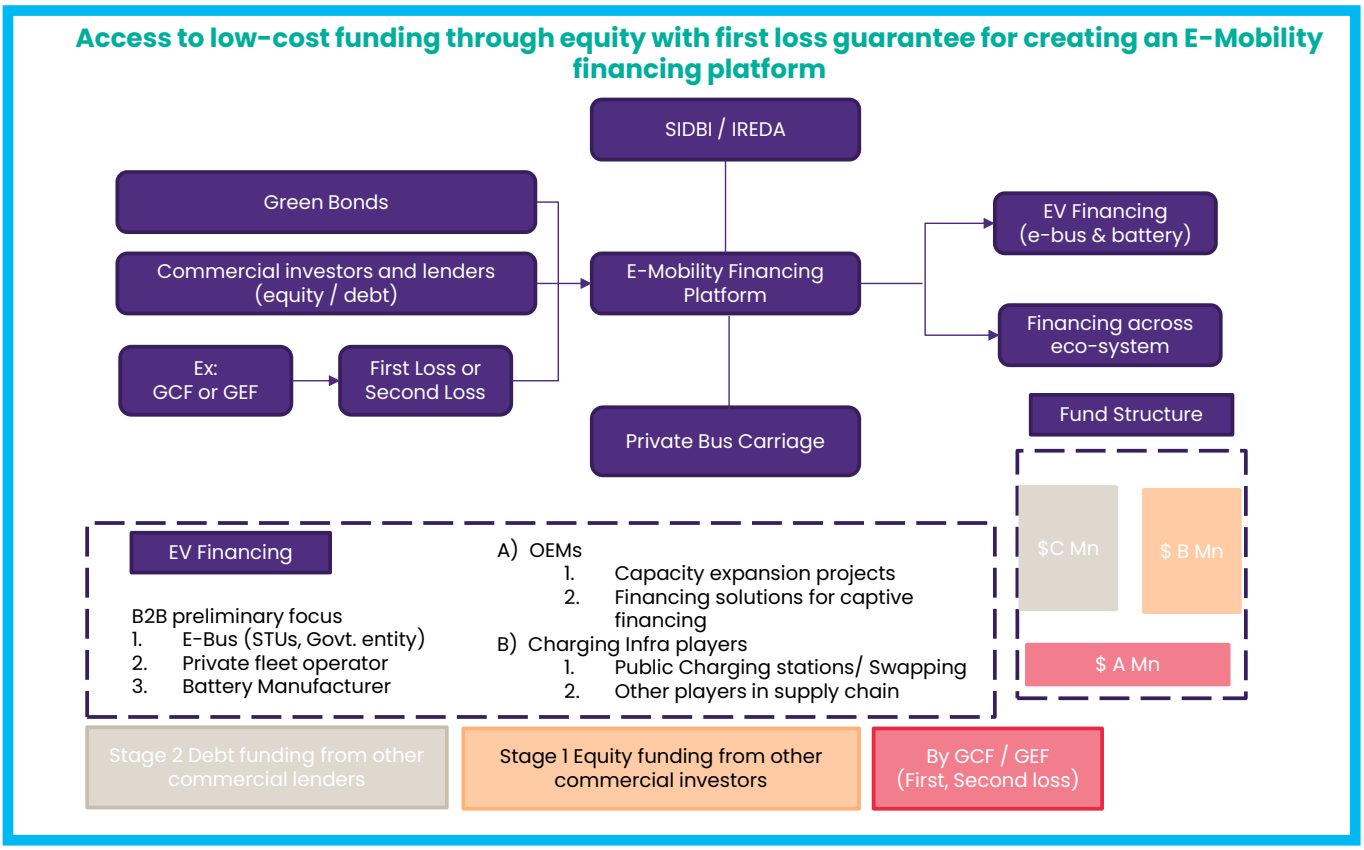

Figure 26: Risk Sharing Facility Model for E-Buses

4.5.5 Develop a Secondary Market for E-buses

Currently, the resale value of electric buses is perceived to be lower than that of internal combustion engine (ICE) equivalents. Creating a secondary market for used electric buses can alleviate one of the major concerns for financiers—the potential value recovery from the asset in case of default.

Original Equipment Manufacturers (OEMs) play a crucial role in developing this secondary market. They can introduce targeted buyback schemes for electric buses, providing assurance to new e-bus operators about the existence of a reliable resale market. OEMs should identify eligible models and detail the entire process from vehicle collection to resale. Furthermore, supporting dealers in the resale process is essential. OEMs should integrate the dealer network into the resale market for used electric buses and roll out the proposed scheme effectively. In order to further increase the demand for used electric buses, the government may also introduce non-fiscal regulatory incentives such as streamlined permits, certification, and approval processes etc.

Encouraging the establishment of a well-defined secondary market for used electric buses will not only enhance their perceived residual value but also attracting fleet operators to the electric bus segment. A robust secondary market can mitigate concerns about resale value, making investment in electric buses more appealing for operators. It will also provide financiers with greater confidence regarding the recoverable value of the asset, thereby reducing risk perception and promoting financing for electric bus purchases.

05 Electric 4-Wheeler

5.1 Market Overview

The adoption of electric four-wheelers in India currently stands at 2%, with commercial electric four-wheelers at a slightly higher 4%. The market has shown rapid growth, as evidenced by the increasing stock of electric four-wheelers, which surged from 20,633 in 2020 to 1,86,387 by April 2024. This significant rise highlights the accelerating shift towards EVs in the 4-Wheeler segment in the country.

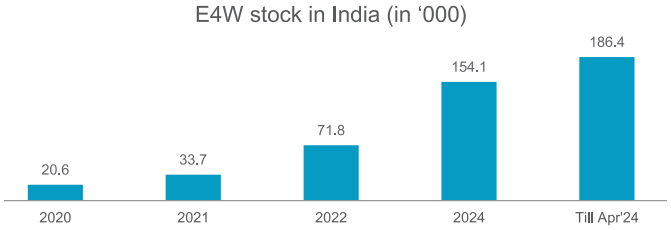

Figure 27: Historical E-4W Stock

Unlike the fragmented electric 2-Wheeler market with numerous players the electric 4-Wheeler market is dominated by a few key manufacturers.

Tata Motors stands as the undisputed leader in the electric four-wheeler market, commanding an impressive 70.52% market share. Following Tata Motors, MG Motors and Mahindra have a share of 12.68% and 5.47% respectively emphasizing their emerging focus in the evolving electric mobility sector. Other players like PCA Automobiles and BYD India, make up for 2.96% and 2.40% of the market respectively. [41]

5.2 Policy and Regulatory Support for Deployment of E-4 Wheelers in India

5.2.1 Scheme to Promote Manufacturing of E-Cars

The scheme was launched in March, 2024 and aims at promoting India as a manufacturing hub of Electric Cars. It provides a three-year timeline for the establishment of manufacturing facility. Minimum Domestic Value Addition of the said facility has been mandated at 25% by the third year and 50% by the end of the fifth year. It also has a provision of reduced Custom duty of 15% on import of CBUs.

5.2.2 Direct Financial Incentives

Many states are giving direct financial incentives of their own to encourage adoption in E4W segment.

5.3 TCO Analysis

TCO per kilometer for both conventional two-wheelers and E4Ws is lowest when they are used for commercial operations with higher daily utilization rates (>100 km per day) viz. use by fleet aggregators.

a) Capex costs for EV is considered 1.7 to 2.0 times of ICE variant.

b) There is no demand subsidy on EVs.

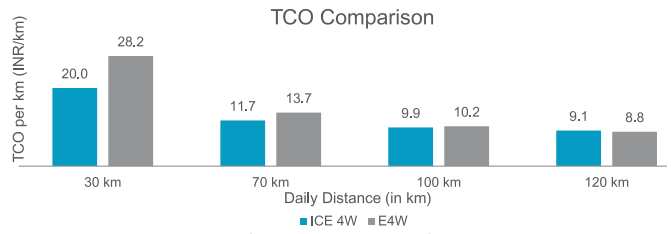

Figure 28: TCO Comparison between ICE 4W and E-4W

High daily usage helps spread out the fixed costs (like upfront costs) over a larger number of kilometers, reducing the cost per kilometer and leveraging the low operating costs of EVs.

Fleet aggregators, who manage many vehicles for commercial use, benefit the most from this constant vehicle usage, maximizing efficiency and minimizing downtime. This results in a low TCO per kilometer for E4Ws in high-utilization scenarios.

5.4 Challenges

1. **Limited Financing Options:** Fewer banks and Non-Banking Financial Companies (NBFCs) are willing to lend for EVs. This limited availability of financing options makes it difficult for potential buyers to secure loans.
2. **Lack of Competitive Loan Options:** The scarcity of competitive loan options means that buyers do not have access to favorable interest rates and terms, further increasing the overall cost of financing an EV.
3. **Unestablished Resale Value of Batteries:** The resale value of EV batteries remains uncertain as secondary recycling markets are yet to be established. This uncertainty affects the overall resale value of EVs, making them a less attractive investment.
4. **Lack of Traceability of Battery Health:** The absence of advanced telematics solutions means that tracking the health and performance of EV batteries is challenging. This lack of traceability can lead to concerns about battery longevity and reliability, impacting the confidence of both buyers and lenders.
5. **Lack of fast-charging Infrastructure:** It not only limits the convenience of using EVs for long-distance travel but also contributes to range anxiety among potential buyers. The existing infrastructure often faces issues such as long wait times, compatibility concerns, and inconsistent charging speeds.

5.5 Solutions

1. **Lower-Cost Financing Options:** To support this, lower-cost financing options can be made available specifically for fleet operators. Fleet operators with weaker financial statements often struggle to access traditional credit facilities. Offering them avenues to secure green bonds or climate finance can provide the necessary capital to scale operations.
2. **Leasing Financing:** Since batteries account for a significant portion of an EV's cost, leasing models—where the battery is leased or rented separately—can dramatically lower the initial price point. This model facilitates the adoption of leasing, making E4Ws more accessible and affordable. This approach not only lowers the entry barrier but also encourages the development of dedicated infrastructure for battery management.
3. **Developing Mechanisms to Aggregate Demand:** Agencies like CESL can aggregate demand, leading to significant reductions in vehicle upfront costs due to bulk purchasing. This also facilitates access to low-cost funds for fleet operators, making it easier for them to adopt E4Ws.

[41] Maker-Wise 4-Wheelers Sales- Vahan Dashboard and JMK Analytics Report- Indian EV Market

06 E-Freight

6.1 Market Overview

India's economic progression has been significantly bolstered by the Medium and Heavy-Duty Vehicle sector. This sector, while crucial for transportation and logistics, has also led to a surge in energy consumption and carbon emissions due to its reliance on conventional fuel sources. Presently, MDHV accounts for 2% of the on-road fleet yet is responsible for 15% of vehicle kilometers traveled.

This disproportionate energy usage and pollutant emission are concerning as projections indicate doubling of emissions by the year 2040, with on-road fuel consumption making up 45% of CO2. This translates to concerning levels of energy consumption and emissions, with projections indicating a potential doubling of emissions by 2040.

Figure 29: Disproportionate Contribution of Current Freight to on-road CO2 emissions.

The shift towards EVs in the medium- and heavy-duty freight sector in India has progressed slowly, largely due to factors like high upfront costs, limitations in battery capacity, and concerns over payload capacity. Despite these challenges, the significant environmental advantages and the alignment with international goals for reducing emissions make a strong case for the adoption of electric freight vehicles in India.

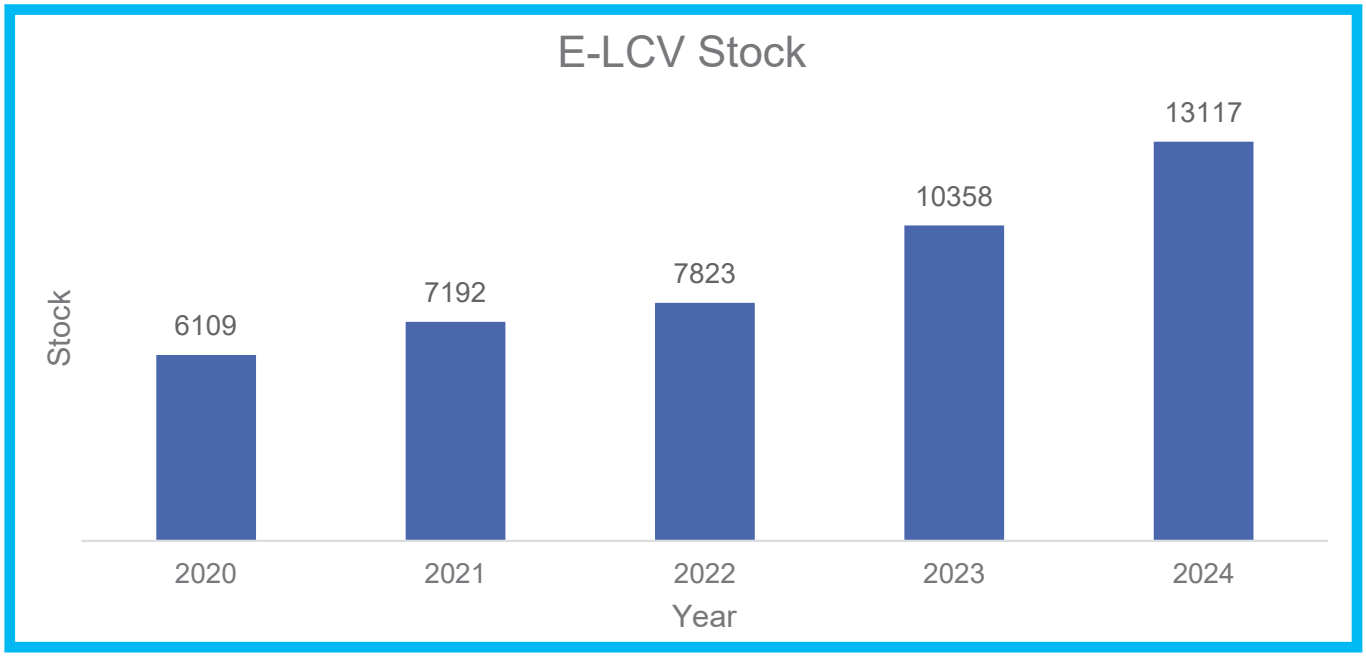

Figure 30: E-LCV Stock

Initiatives like the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme and production-linked incentives (PLIs) have fueled significant growth in passenger EVs. However, the EV freight segment remains in its early stages.

6.1.1 Prominent Models

Some of the prominent E-LCV Models and their specifications include:

EV Manufacturers	Models	Battery Capacity (kWh)	Range (km)
Eicher	E Pro 2049	64.5	130
Omega Seiki Mobility	Mika 3.0	96.77	180
Ashok Leyland	Boss EV	300	300
IPLT	Rhino 5536	260	185
Mahindra	E-Trio	20	115
Tata Motors	Ace-EV	21.3	154

Table 13: E-LCV Models- Battery Capacity & Range

6.1.2 Challenges in E-Freight Segment

1. **Capex Costs**
   - ➢ Battery Costs:
     - Lithium-ion battery technology is still evolving, and the materials needed for high-density batteries are expensive (e.g., lithium, cobalt, nickel).
     - The sheer size of batteries required for e-HDTs to travel long distances with heavy loads significantly increases the cost.
   - ➢ Non-Battery Component Costs:
     - Electric motors and powertrain management systems in e-trucks are more complex than diesel engines, requiring advanced components and specific expertise for maintenance.
     - While these technologies are expected to become cheaper with wider adoption, the initial investment remains high.
2. **Limited Model Options and Uncertainty regarding TCO:**
   - ➢ Manufacturer Hesitation:
     - The relatively new EV truck market presents a higher risk for manufacturers compared to established diesel trucks.
     - Without strong government incentives, regulations mandating emission reductions, or guaranteed high demand, manufacturers are cautious about investing in a wider range of e-truck models.
   - ➢ Fleet Management Concerns:
     - Fleet operators grapple with uncertainties about the total cost of ownership (TCO) for e-trucks, including battery degradation, maintenance costs, and potential resale value.
     - The lack of established practices for servicing and maintaining e-trucks adds to the apprehension.
     - Furthermore, the limited variety of e-truck models with varying capabilities makes it difficult for fleet managers to find the perfect fit for their specific needs.
3. **Charging Infrastructure:**
   - ➢ Charging Network Coverage:
     - The current charging infrastructure is primarily designed for passenger EVs with shorter ranges.
     - There's a significant lack of high-powered charging stations, especially along long-distance trucking routes.
     - This scarcity adds to trip times and reduces operational efficiency for e-freight companies.
   - ➢ Grid Capacity and Power Management:
     - Charging a massive e-truck battery requires significant power, potentially straining existing electricity grids, especially during peak hours.
     - Upgrading grids and implementing smart charging solutions that optimize energy use during off-peak hours are crucial for wider EV freight adoption.
4. **Payload vs. Battery Capacity:**
   - ➢ Battery Weight Optimization:
     - Battery manufacturers are constantly working on increasing energy density (more power per kilogram) to reduce battery weight for a given

range. However, significant breakthroughs are still needed to achieve payload capacities on par with diesel trucks.

- Route Planning and Optimization:
  - E-freight companies need to carefully plan routes considering charging station availability, weight restrictions, and potential range limitations.
  - Optimizing routes for shorter distances or utilizing strategically placed depots for intermediate charging can help mitigate payload limitations.
  - Some manufacturers are exploring alternative battery placement strategies (e.g., under-chassis mounting) to minimize the impact on cargo space.

6.2 Policies and Regulatory Frameworks

The table below provides a comprehensive overview of various initiatives aimed at promoting zero-emission transportation in India. These initiatives range from policy measures to technological advancements and strategic collaborations.

Initiative	Description
FAME Phase III	India is considering extending demand incentives to e-trucks in the next phase of the FAME
National Level Initiatives	**E-FAST Platform by Niti Aayog:** Launched in Sep'22, Electric Freight Accelerator for Sustainable Transport (E-FAST) brings together stakeholders in freight value chain. **ZET High-Level Ambition Group (ZET HLAG) by CALSTART,** this coalition includes top OEMs, aiming to identify policies and incentives for ZET sector.
ZET Corridor Development	**Electric Highways**: Developing electric highways with overhead lines, solar power charging. **ZET Demonstration Pilots**: To test new technologies and business models, prioritizing special economic zones. Announced at the 14th Clean Energy Ministerial meeting.
Zero-Emission Freight Cluster	- **Location**: West coast of Gujarat and Maharashtra. - **Commitment**: Deployment of over 550 zero-emission trucks in the next 18-24 months

Table 14: Policies & Regulatory Frameworks for ZET Transportation in India

State level initiatives: While mostly all the states offer subsidies like road tax exemptions and waiving registrations taxes on EVs, only few provide direct incentives for E-Freight.

- There are signs of progress though, with 17 states demonstrating a commitment to building fast-charging infrastructure or battery-swapping stations along major highways.
- Additionally, a few states like Andhra Pradesh, Uttar Pradesh, Assam, and Madhya Pradesh have set ambitious goals to phase out all fossil-fuel based commercial fleets by 2030.
- When it comes to subsidies for buying medium- and heavy-duty electric vehicles, Haryana is the only state that offers incentives for e-tractors.

6.3 Challenges in EV Financing

Dominance of Small Companies and Perceived Credit Risk

a. **Fragmented Market with Limited Regulation:** The demand for goods and freight movement in India is not centralized. The market, characterized by limited regulation and low barriers to entry. Over 75% of the market is comprised of small owner-operators, each owning fewer than five commercial goods carriers.

b. **Unattractiveness to Creditors:** The high proportion of smaller regional aggregators leads to a highly fragmented market, resulting in unsustainably low returns. Due to high business risk, these small carriers are unattractive to creditors. The market's revenue uncertainty further elevates the credit risk associated with borrowing.

c. **Financing Through NBFCs:** Most new freight vehicles are financed through Non-Banking Financial Companies (NBFCs), which are less risk-averse than banks but impose higher interest rates. These loans typically come with interest rates between 12% and 16% and have tenures of three to four years.

Lending institutions perceive financing for Zero-Emission Trucks (ZETs) as riskier due to the higher costs of ZETs and uncertainty about their future resale value. In a market where even financing less expensive, conventional trucks is seen as risky because of business uncertainties, financial institutions often impose more stringent conditions on loans for E-freight. These conditions generally include higher

interest rates, shorter loan tenures, and lower loan-to-value ratios, an approach designed to mitigate the perceived risks associated with financing ZETs:

- **Technology Risk**

  There is a lack of reliable data on EV performance—in terms of range, asset life, battery, O&M. There are also concerns about limited warranty of vehicles for the operational life.

- **Counter Party Default Risk**

  The weak balance sheets of Operators are a major problem. Operators face highly leveraged balance sheets due to the higher capital expenditure required for MDV/ HDV trucks.

- **Regulatory and Infrastructure Risk**

  There is also lack of defined state / central level policies for e-freight segment. Lack of adequate public fast charging infrastructure, charging across expressways is also a major risk.

- **Residual Risk:**

  There exists uncertainty of realizing value from repossess assets due to nascent secondary market. High depreciation rates of batteries and high battery replacement costs further exacerbate the issue.

- **Business Model Risk:**

  For operators, bankability depends on utilization, as EVs are viable at high utilization. There is a dearth of well-established operational models, unlike E2W, E3W segment

These risks collectively result in high interest rates, low loan-to-value ratio, limited financial institutes, lack of financial instruments.

6.4 Solutions and Financing Frameworks

Innovative financing frameworks for E-freight can catalyse market growth and accelerate deployment. To mitigate financial risks and improve credit accessibility, it's crucial for govt., lenders, and industry stakeholders to collaborate, as each has a different role in enhancing access to finance for e-freight.

6.4.1 Risk Sharing Facility

Financial institutions perceive a higher risk in lending for EVs due to increased operational and asset risks compared to internal combustion engine (ICE) vehicles. Consequently, lending for EVs often features lower loan-to-value (LTV) ratios, shorter tenures, and higher interest rates, although some variation exists across different vehicle segments, influenced by the credit profile of the borrower.

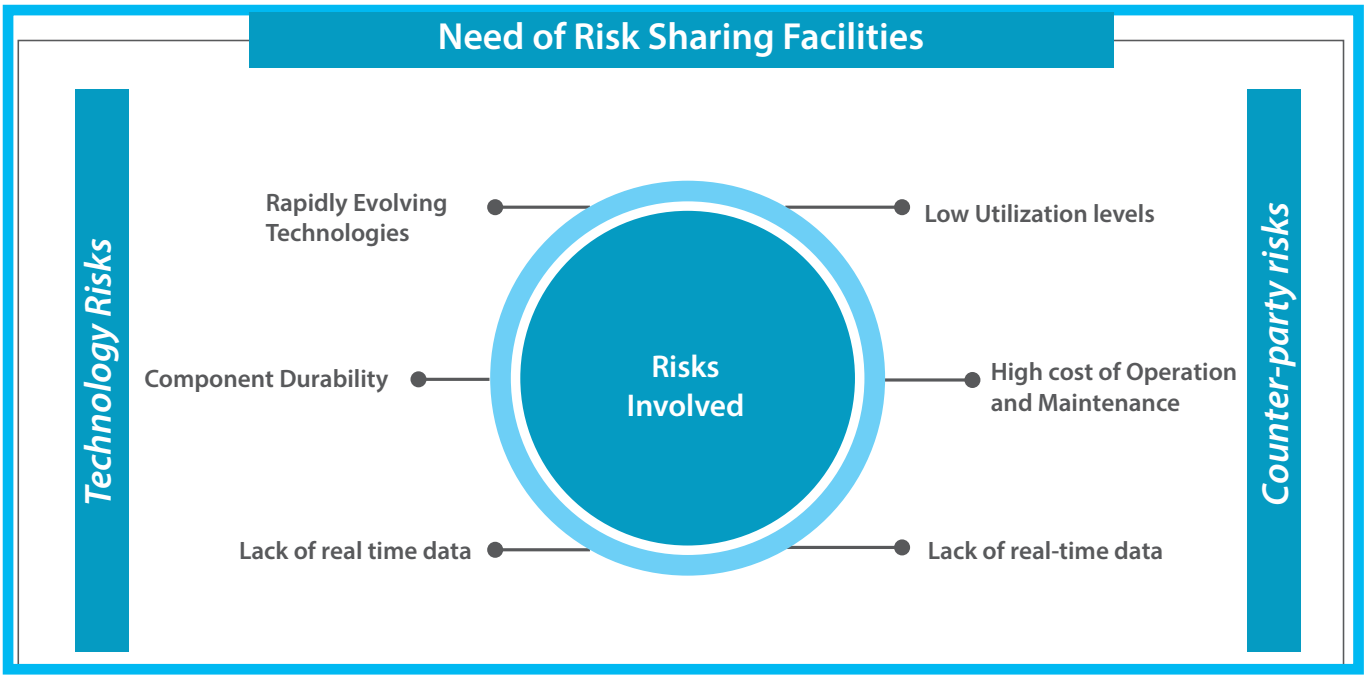

Figure 31: Need of Risk Sharing Facilities

Financial institutions encounter challenges in assessing risks associated with lending for EV purchases, primarily due to:

- The absence of an established resale value for EVs in the event of customer default and vehicle repossession; and
- Uncertainty surrounding vehicle performance, including:
- Suitability—whether the vehicle or ecosystem meets the required transport services.
- Reliability and durability—whether the vehicle achieves the lifespan of critical components, such as the battery and motor, as claimed or expected.

Allocating loan reserves to provide guarantees for zero-emission technologies (ZETs) helps in risk distribution for lenders in the event of a loan default. Multilateral and bilateral development banks can contribute as financiers of risk-sharing facilities, with public sector banks serving as the managers of these facilities. Governments could integrate ZETs into existing programs targeting enterprise owners and small road transport operators, instead of creating dedicated schemes for interest subvention or risk-sharing (e.g., credit guarantees).

Such mechanisms would distribute risk and offer financial institutions (FIs) an opportunity to build trust in the sector. Fleet operators could also use their existing FI relationships to offer partial credit and utilization guarantees.

6.4.2 Decoupling Battery and Vehicle Financing:

In order to enable leasing, swapping, and pay-per-use models for electric freight vehicles, a decoupling of the battery from the vehicle is essential. This allows for separate consideration of risks associated with the battery and the vehicle, presenting opportunities for both financiers and customers. Here's how the financing framework could be structured:

- The battery and the vehicle will be treated as separate entities in terms of financing.
- Customers can opt for leasing the battery, swapping services, or pay-per-use models,

Operating leases provide flexibility, allowing operators to upgrade their vehicles at the lease's end. This is particularly beneficial given the rapid advancements in EV technology. Battery leasing can address concerns related to battery life and performance degradation, providing operators with the option to replace batteries without investing in new **vehicles.**

Mechanism - Operational Leases and Telematics

Operational leases, offered directly through EV OEMs, streamline vehicle operations by integrating data sharing through telematics. This approach provides real-time insights into vehicle performance, aiding in proactive maintenance and fleet optimization. Operators can manage the lifecycle costs of batteries independently from the vehicles, enhancing operational flexibility.

Key Features

- Per-Kilometer Payments: Battery leasing involves payments structured on a per-kilometer basis, correlating directly with usage.
- Telematics Data: Battery usage data is gathered via telematics systems connected to the Battery Management System (BMS), with financial institutions having agreements with OEMs for data access.

6.4.3 Develop a Secondary Market for EV Freight

The resale value of EV freight is perceived to be lower than that of internal combustion engine (ICE) equivalents due to its current adoption in practice. Creating a secondary market for used EV freight can alleviate one of the major concerns for financiers—the potential value recovery from the asset in case of default.

1. **OEM Involvement:**
   - Buyback Schemes: OEMs can introduce buyback schemes for EV freight vehicles, similar to those for electric buses. This would provide assurance to new operators about the resale value.
   - Eligible Models: Identify which models are eligible for buyback and detail the process from vehicle collection to resale.
2. **Dealer Network Integration:**
   - Support Dealers: OEMs should support dealers in the resale process, ensuring they are well-integrated into the secondary market.
   - Training and Resources: Provide training and resources to dealers to handle the resale of EV freight vehicles effectively.
3. **Government Incentives:**
   - Regulatory Incentives: Introduce non-fiscal regulatory incentives such as streamlined permits, certification, and approval processes to encourage the resale of E-freight vehicles.
4. **Market Awareness:**
   - Promotional Campaigns: Conduct promotional campaigns to raise awareness about the benefits of EV freight vehicles.
   - Charging Infrastructure: Ensure there is adequate charging infrastructure to support the operation of EV freight vehicles.

07 EV Charging Infrastructure in India

7.1 Market Overview

As of March 2024, India has over 25,303 operational public EV charging stations across the country[42], with 30,471 public EV charging points catering to a total of 4 million EVs[43]. To support the anticipated growth in EV demand, a substantial scale-up of charging infrastructure nationwide is required. The widespread and reliable availability of EV charging infrastructure is essential for making EVs mainstream in India.

I. State-wise Adoption

Several states in India have emerged as frontrunners in the deployment and adoption of EV charging infrastructure. Karnataka, Maharashtra, Delhi, and Kerala are among the states which have implemented various supportive policies, incentives, and regulatory enablers to encourage the use of EVs and the development of necessary infrastructure.

S. No.	State	No. of PCS[44]	S. No.	State	No. of PCS
1	Karnataka	5765	6	Kerala	1212
2	Maharashtra	3728	7	Rajasthan	1129
3	Uttar Pradesh	1989	8	Gujarat	992
4	Delhi	1941	9	Telangana	956
5	Tamil Nadu	1413	10	Madhya Pradesh	903

Table 15: Top 10 Indian States – Number of PCS

Figure 32: Distribution of EV PCS across states

[42] BEE EV Yatra Portal
[43] Vehicle Sales, VAHAN Dashboard
[44] BEE EV Yatra Portal

II. Charging Modes and Connectors

In the Indian context, charging infrastructure can be broadly categorized into four main types: private, semi-public, captive and public charging facilities. Different vehicle categories—such as two-wheelers, three-wheelers, four-wheelers, electric trucks, and buses—use specific charging connectors that cater to their unique requirements.

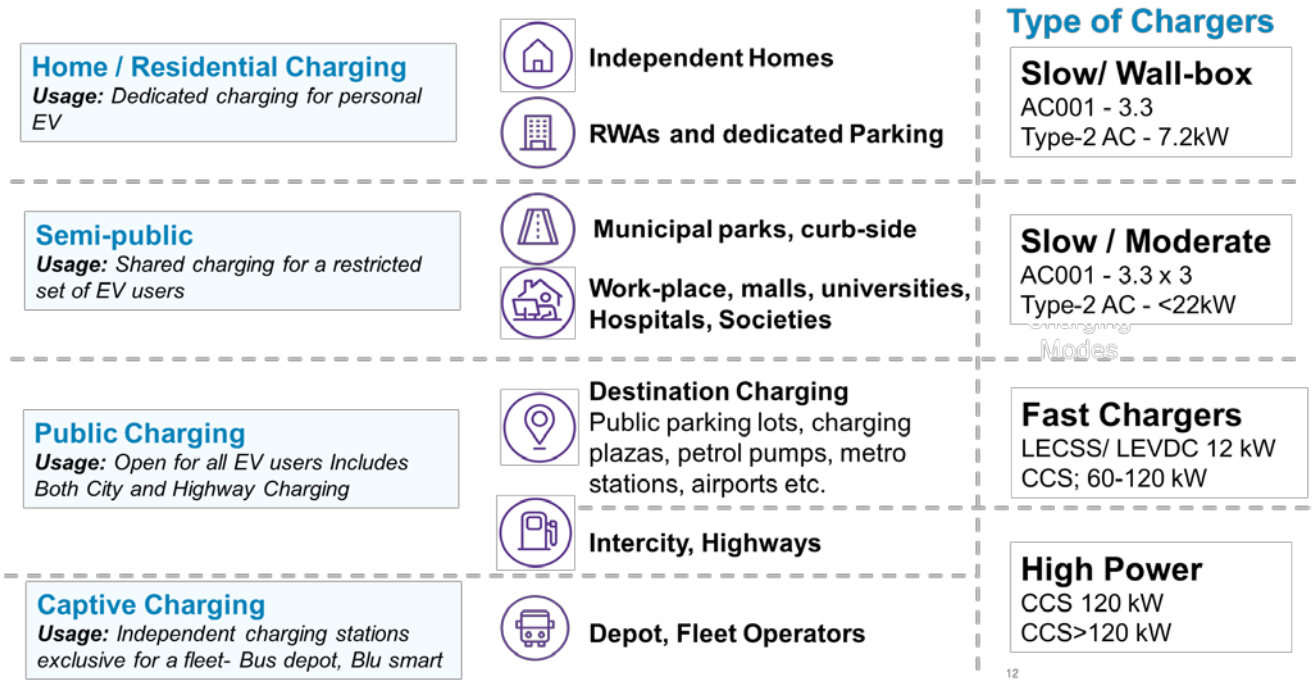

Figure 33: Charging Modes and Connectors

III. Capex Requirement for EV Chargers

The financial requirements for setting up chargers vary significantly depending on the capacity of the chargers. Below is a detailed cost analysis for different charger types across various EV segments, highlighting the unit costs, additional electricity infrastructure costs, per charger for different charger types across various EV segments.

Segment	Charger Type	Capacity (in kW)	Per Charger Cost (in INR)	Electricity Infra Costs (in INR)
E2W/3W- Slow	LECCS /LEVDC	12 kW	1 - 1.50 lakhs	0.50 – 1.00 Lakhs
E4W – Slow	Type-2 AC	7.4-22 kW	0.50 – 1.00 Lakhs	0.50 – 1.00 Lakhs
E4W / LCV – Fast	CCS-2	100 /120 kW	10-12 Lakhs	~14.80 Lakhs
E-Bus & HDV- Fast	CCS-2	240 kW	18- 22 Lakhs	~24 Lakhs

Table 16: Top 10 Indian States – Number of PCS

The charger requirements for two-wheelers and three-wheelers have a smaller ticket size, requiring less investment. Consequently, these chargers are typically installed in housing societies or Residential Welfare Associations (RWAs). In contrast, the public charging infrastructure for four-wheelers demands a more significant investment. These chargers are primarily located in public places and are typically implemented by CPOs.

7.2 Policy and Regulatory Support for EV Charging Infrastructure in India

7.2.1 FAME Scheme:

MHI sanctioned around 520 charging stations/infrastructure projects with a budget of approximately Rs. 43 crores under Phase-I of the Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) Scheme. This resulted

in the establishment of 452 charging stations in various cities across India under FAME-I.[45]

For Phase-II of the FAME India Scheme, a budget of Rs. 1000 crore has been allocated over five years (2019-20 to 2023-24) to develop charging infrastructure. FAME-II included subsidies of up to 70% for commercial public charging stations and 100% for non-commercial government/ institutional charging stations are provided, based on the cost of the EV supply equipment.

Additionally, In March 2023, to enhance the viability of public charging infrastructure, additional financial assistance for up to 80% of the cost of upstream infrastructure (e.g., distribution transformers, cables, protection equipment, mounting structures, fencing, and civil work) was introduced.

Under this scheme, the Ministry of Heavy Industries has sanctioned 2,877 electric vehicle charging stations in 68 cities across 25 states and Union Territories[46]. Additionally, 1,576 charging stations across 9 expressways and 16 highways have been sanctioned, although only 148 public charging stations have been deployed as of February 2024.

To address the challenge of insufficient land availability faced by Charge Point Operators (CPOs), the Ministry of Heavy Industries sanctioned Rs. 800 Crore to oil marketing companies (OMCs) to set up 7,432 public charging stations at existing OMC retail outlets by December 2024. Additionally, the MoPNG has set a target to establish 22,000 EV charging stations through three OMCs—IOCL, BPCL, and HPCL—across the country[47].

Furthermore, the Phased Manufacturing Program (PMP) under the FAME India Scheme promotes domestic manufacturing of electric vehicles and charging components, thereby increasing Domestic Value Addition (DVA). Compliance with the PMP is required to avail the FAME subsidy from 2024 onwards. The latest PMP guidelines for electric vehicle public charging stations under the FAME-II scheme were notified by the Ministry of Heavy Industries in 2021, with amendments made in 2023[48].

7.2.2 Guidelines & Standards for Charging Infrastructure for Electric vehicles (2018)

With the accelerated adoption of EVs across the country, the Ministry of Power (MoP) set detailed responsibilities encompassing regulatory oversight, tariff structuring, infrastructure development, and stakeholder incentives. The guidelines and standards for charging infrastructure for electric vehicles in India were first issued in 2018. Subsequently, they were amended, with the last amendment proposed in 2024.

These guidelines emphasize the development of an extensive and accessible charging network, ensuring that EV users have reliable and convenient charging options. Key provisions include the classification of charging stations into public and private categories, stipulating technical and safety standards, and encouraging the use of renewable energy sources for charging operations. The guidelines also mandate the installation of charging points in new buildings and parking lots, promoting the integration of EV infrastructure in urban planning.

Ministry of Power has clarified in 2018 that no license is required for establishing public EV charging stations in India under Electricity Act, 2003. By addressing this regulatory concern, private players and individuals have been encouraged to set up charging facilities, thereby promoting widespread adoption of electric vehicles.[49]

Additionally, incentives and support mechanisms are provided to attract private investments in the EV charging sector, with a focus on interoperability and standardization to ensure seamless user experiences across different charging networks. These measures are designed to create a robust framework that fosters the widespread adoption of electric vehicles, contributing to India's goals for sustainable and eco-friendly transportation.

7.2.3 Amendments in Building by-laws

To foster the growth of EV charging facilities within commercial and residential building complexes, a significant policy and regulatory impetus has been provided through an amendment in the Model Building Bylaws (MBBL) and Urban and Regional Development Plans Formulation and Implementation Guidelines. A key provision of the amended bylaws is the requirement for buildings to allocate a minimum of 20% of their total vehicle holding capacity or parking spaces for the installation of EV charging facilities.[50]

7.2.4 Concession in Goods and Services Tax

In 2019, Ministry of Finance rationalised the customs duty for all categories of vehicles, battery packs and cells to support Make in India. It also reduced the GST rates for the purchase of electric vehicles from 12% to 5% and announced income tax rebate of INR 1,50,000 on purchase of electric vehicles. The tax rate is also reduced from 18% to 5% on EV charging equipment. [51]

7.3 Financial Feasibility

The financial feasibility of EV charging infrastructure projects is crucial for ensuring that investments are both sound and sustainable. Due to low utilization, high electricity tariffs, and upstream infra costs, EV charging tariffs are very high in India, making them unaffordable.

[45] PIB Press Release on Charging Stations sanctioned by MHI
[46] Sansad Document on Guidelines on Charging Infrastructure
[47] PIB Press Release on Sanctions to OMCs for EV PCS Deployment
[48] Sansad Document on Production of EV Charger Components
[49]Charging Infrastructure for Electric Vehicles – Guidelines and Standards Document
[50] Amendments in Model Building Bye-Laws for Charging Infrastructure Policy Document
[51] Income Tax Deduction by MoF Notification

- EV Charger Utilization - 1-10%
- Electricity Tariff - 3.6 - 18 INR/kWh (Avg 7.00 Rs)[52]
- EV Charging Tariff (EV-user) - 21-28 INR / kWh

Financial Feasibility for **CCS-II 100 kW Charger at 5% Utilization (HT Connection)**

Cost Components	Tariff Contribution (INR/kWh)	Share (in %)
EVSE Equipment	4.12	17%
Electricity Infra	6.10	25%
Land Lease	1.00	4%
AMC/Insurance	0.77	3%
CMS/IT	0.47	2%
Manpower	2.10	8%
Electricity Tariff (Delhi)	4.00	16%
Duty on tariff	2.41	10%
Tariff (Excl. GST)	**20.97**	
GST (@18%)	3.77	15%
Tariff (Incl. GST)	**24.75**	

Table 17: Breakdown of Cost Components of EV Charging Tariff

- In the total tariff to the end user for EV charging, which varies between 21-28 Rs/kWh, almost 25% of the cost is attributed to upstream electricity infrastructure.
- Electricity tariffs, along with duties, contribute to almost 25% of the charging cost.

7.4 Financing Challenges:

7.4.1 High Capex Requirement

Setting up EV charging stations requires substantial upfront investments in hardware, such as charging units, cabling, transformers, and grid connections. The high costs associated with establishing this infrastructure pose a significant challenge that must be addressed. The key aspects of this challenge include:

a) **Charger (EVSE) Cost:** The charger costs vary depending on the charging capacity (50/60kW, 100/120kW, or DC fast charging). Additionally, the dependency on imported parts like power electronics and AC-DC connectors further inflate the initial costs.

b) **Upstream Infrastructure Cost-** Fast chargers require high-capacity connections, which, in most states, are not permitted for low-tension (LT) connections, necessitating HT connection for these chargers, further increasing the infrastructure costs. Upstream infrastructure costs more than the charger equipment due to the associated costs related to installation of transformer, cabling costs and electricity connection costs.

Description PCS	Transformer Rating kVA	EV charger cost (In lakhs)	Upstream infra cost (In lakhs)	% of Charger Cost
50 kW	63	7.25	6.04	83.31%
100 kW	160	12.49	14.80	118.49%
150 kW	200	12.84	19.00	147.98%
>150 kW	250	20.00	24.00	120.00%

Table 18: Estimated Upstream Infrastructure Cost for various charger capacities.

c) **Limited financial incentives and subsidies for private investors:** Currently, incentives and subsidies are primarily focused on Public Sector Units (PSUs) and Oil Marketing Companies (OMCs), leaving private investors, who are crucial for large-scale development, without access to crucial financial support.

7.4.2 Operational Challenges

a) **Operational Expenses (OPEX):** The ongoing costs of operating and maintaining charging stations, including electricity costs, staffing, software and hardware maintenance, and customer support, strain the financial viability of charging providers at low utilizations.

b) **High Electricity Tariff and Demand Charges:** The Ministry of Power has issued guidelines for tariff setting for EV charging stations in India. However, these guidelines are not being implemented judiciously by state governments, leading to variations in tariffs across different states. Only a few states, including Goa, Bihar, Odisha, Uttar Pradesh, Punjab, Delhi, West Bengal, Himachal Pradesh, Andhra Pradesh, and Madhya Pradesh, have waived off fixed demand charges for EV charging stations.

In many other states, fixed demand charges remain high, with some states imposing charges of more than INR 200 per kVA per month. States with higher fixed demand charges tend to have higher total tariffs.

While the Ministry of Power guidelines specify tariff ceilings (±20% of the Average Cost of Supply) during solar and non-solar hours, the lack of an effective implementation mechanism has resulted in only 15 out of 36 states adhering to these guidelines.

c) **Complexities of Land Acquisition –** The identification and allocation of suitable land are crucial for the success of the EV charging business. Although some states assist in land acquisition, industry participants report persistent administrative challenges in the process. Moreover, uncertainty regarding long-term lease rentals further complicates the matter.

[52] CEA Document on Electricity Tariffs

7.4.3 Financing Risks

EV Charging introduces multiple asset risks and business model risks that financial institutions (FIs) and insurers must navigate. Understanding these risks is essential for creating robust financing frameworks and supporting the growth of the sector.

The financial risks stem from a range of interconnected factors as discussed above, including technological uncertainties, inconsistent policies, high initial costs, lack of proven track record of manufacturers, low utilization rates, unaccepted business models, and uncertain asset lifespan.

Figure 34: EV Charging Financing Risks

I. Technological Risk

- FIs are hesitant to invest due to the lack of reliable data on EV charging operations, including daily utilization, maintenance requirements, lack of predictability in revenue due to lower EV penetration.
- Insurers are wary of covering what may be considered unproven technology and components, compounded by the absence of comprehensive guarantees or warranties from manufacturers.
- The rapid advancements in EV charging technology create a risk of charging stations becoming obsolete, making it difficult for lenders to assess and manage investment risks accurately.

II. Policy Risk

- FIs seek clear and consistent national and state-level policies that support EV charging adoption. Uncertainty in policies and difficulty in accessing incentives heighten the perceived risks of EV charging financing.

III. Manufacturer Risk

- Many EV charger manufacturers, especially new entrants, lack a proven history of product performance and service reliability, making FIs hesitant to onboard them in formal lending procedures.
- Some EV Charger OEMs operate at low or negative margins, to capture the more market, increasing the risk to FIs regarding the manufacturer's financial health.

IV. Resale Risk

- The nascent state of the EV charging market, makes it difficult to determine the useful life of charging station, resulting in reduced resale values due to the underdeveloped secondary market.

V. Low Utilization Rates and Profitability

- The utilization rates of EV charging stations in India are currently very low, ranging from 3-6%. This low utilization, coupled with the high charging costs passed on to consumers), makes it difficult for charging stations to achieve profitability with the existing charging tariffs, affecting their financial viability.
- Uncertain return on investment: Due to low utilization rates in the early years and the rapidly evolving nature of EV charging technology, there is uncertainty surrounding the potential returns on investment for financial institutions, making them hesitant to finance these projects.

VI. Uncertain asset lifespan

- The lifespan of charging station assets remains unclear, adding to the uncertainty surrounding the potential returns on investment.

VII. Business models

- Many aspects of the EV charging business, including revenue streams and operational efficiencies, are still being tested in the market, creating uncertainty for financial institutions. Also, EV charger's viability

is contingent on high utilization due to recovery of invested capital.

VIII. Additional Risks and Barriers

- Infrastructure Risk: High Land acquisition / rental costs and High Upstream infra costs- further reduces the repayment capability of CPOs.
- Operations Risk: Operational challenges such as voltage fluctuations, and technical requirements of charging infrastructure are poorly understood. Uncertainties like grid reliability issues decrease FIs' confidence in financing CPOs.

These interconnected challenges of high initial costs (reflected in charging tariffs), low utilization rates due to potential consumer deterrence, and profitability concerns create a cycle of financial challenges that make EV charging infrastructure a risky proposition for both public and private investors, hindering large-scale development of EV public charging infrastructure.

All these risks contribute to higher interest rates and lower loan-to-value ratios, as financiers bear the brunt if borrowers default.

8.1 Associated Challenges

Based on the identified risks the following financing challenges arise:

I. High Interest Rates

Interest rates for loans related to EV charging infrastructure are typically higher than those for conventional projects. Banks might charge higher rates due to perceived risks, significantly increasing the cost of setting up charging stations.

For instance, interest rates for commercially operated EV charging stations could range up to 14-15%, compared to lower rates for less risky investments.

II. Low Loan-to-Value (LTV) Ratios

Financial institutions often offer loans for EV charging infrastructure with low LTV ratios to mitigate risks associated with the nascent technology and uncertain resale values.

This conservative financing approach means that operators need to provide more equity upfront, which can be challenging for small operators or new entrants who may not have sufficient capital.

III. Limited Financing Options

Unlike in regions like Norway, China, the UK, and Australia, where specialized financial products for EV charging are more common, India lacks tailored financing options for EV charging infrastructure.

This forces operators to accept loans with high interest rates, low LTV ratios, and shorter repayment periods, which can hinder the expansion of charging networks.

7.5 Solutions / Financing Frameworks

7.5.1 Continued Fiscal Incentives

Given the high CAPEX associated with establishing such infrastructure, continued fiscal incentives are necessary to make investments in EV charging stations attractive and feasible for both public and private players.

These incentives are crucial until business operations in the EV charging sector become viable through increased utilization rates, the availability of necessary infrastructure, and a rise in EV adoption. The economic rationale includes:

Initial investments in EV charging infrastructure face low utilization rates due to the currently limited number of EVs on the road. Fiscal incentives can bridge this gap by reducing upfront costs and allowing time for the market to grow and utilization rates to increase. As more consumers switch to EVs, driven by supportive policies and an improving charging network, the increased demand will eventually lead to higher utilization rates of charging stations, making the business operations viable without continued subsidies.

The following measures outlines various fiscal incentives that can support the development of public EV charging infrastructure in India.

- **Capital Subsidies and Grants -** Providing financial assistance in the form of capital subsidies and grants can significantly reduce the initial costs involved in setting up EV charging stations. Key measures include:

  a) **Capital Subsidy for Charging Stations:** Offering direct subsidies to private players and public entities to cover a substantial portion of the CAPEX, Upstream infrastructure cost and statutory fees (such as stamp duties for land acquisition, registration fees etc.) for installing public charging stations. This can reduce the financial risk and encourage more stakeholders to invest in the sector. These subsidies can be further linked with domestic manufacturing of EV chargers, enrollment of the charging stations in the centralized hub / unified platform, adoption of standardized connectors, and other value-added services that may contribute to overall infrastructure development in country.

- **Tax Credits and Accelerated Depreciation:**

  a) **Tax Credits:** Offering tax credits to companies and individuals investing in EV charging infrastructure can make these investments more attractive. This reduces the effective cost of investment and encourages broader participation.

  b) **Accelerated Depreciation:** Allowing accelerated depreciation on EV charging equipment can improve project economics. This provides immediate financial benefits, enhancing the return on investment and encouraging quicker deployment of infrastructure.

7.5.2 Innovative Financing Mechanisms

a) **Investment Funds:** Creating dedicated investment funds can pool capital from various sources, providing a substantial financial resource for developing EV charging infrastructure. These funds can attract institutional investors looking for sustainable investment opportunities. Infrastructure investment trusts (InvITs) are one example of structures that can unlock capital, thereby helping developers access fresh capital for incremental project development.

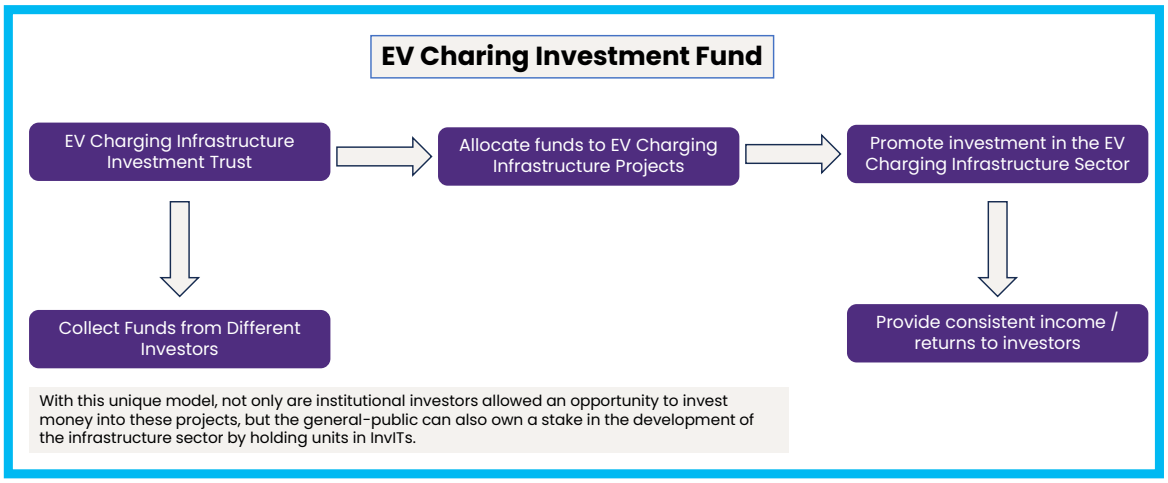

Figure 35: EV Charging Investment Fund Model

b) **Green Bonds:** Governments can issue green bonds specifically for EV infrastructure projects can attract environmentally conscious investors. These bonds, backed by the government, can offer lower interest rates, and attract investment from environmentally conscious investors.

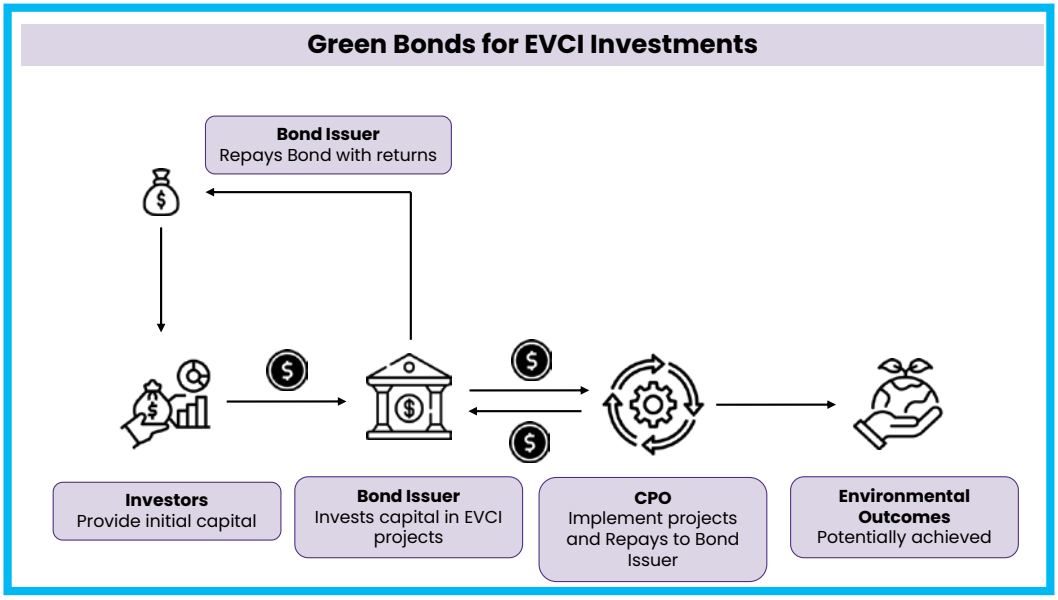

Figure 36: Green Bonds Model for EVCI Investments

- **Concessional Finance:** Providing concessional loans with favorable terms and interest rates through public sector banks and financial institutions for projects related to EV charging infrastructure. This can make financing more accessible and affordable for developers.

7.5.3 Facilitating Financiers through De-Risking Investments

For financial institutions, financing this large-scale deployment of EV charging infra remains a significant hurdle. By de-risking investments for financiers, we can unlock the private capital crucial for building a comprehensive EV charging network across the country. For financial institutions, financing this large-scale deployment of EV charging infra remains a significant hurdle. By de-risking investments for financiers, we can unlock the private capital crucial for building a comprehensive EV charging network across the country.

FIs may be trained to better assess potential returns and investment risks from the EV charging stations. Data from the centralized clearing hub can be utilized for this purpose. By addressing concerns and highlighting the long-term benefits, these campaigns can encourage greater investment from the financial sector.

Risk Mitigation Tools: To protect investments in EV infrastructure, creating risk mitigation instruments is essential. Instruments such as insurance and risk guarantees backed by government / development banks can protect investments against unforeseen circumstances like technological advancements or low initial utilization rates, making EV charging infrastructure a more attractive proposition for financiers.

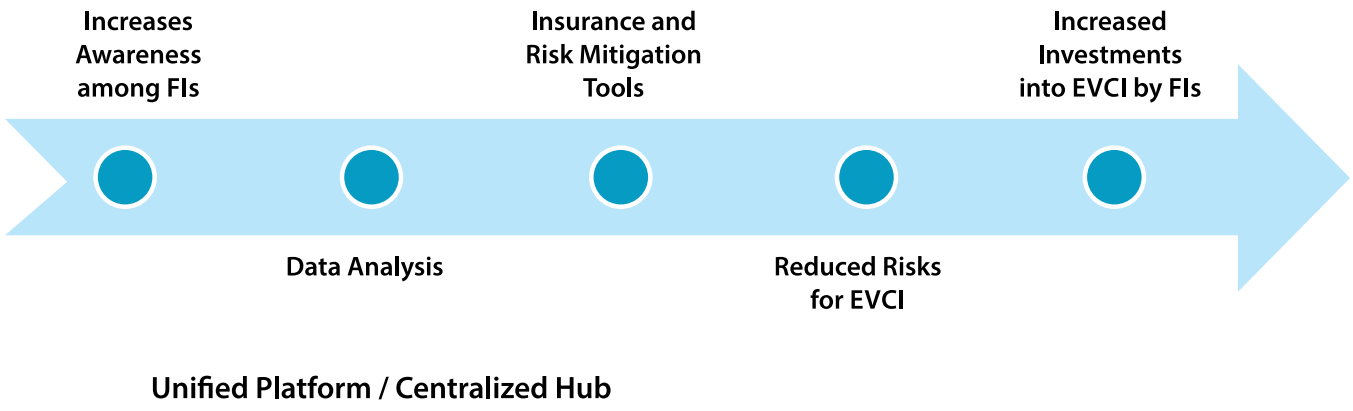

Figure 37: Process of De-Risking Investments

7.5.3 Enhancing Profitability through Innovative Business Models for CPOs

a) **Monetizing Carbon Credits –** Monetizing carbon credits can significantly benefit EV charging point operators in India by providing an additional revenue stream and enhancing the viability of the EV charging business.

b) **Fleet Charging Services:** Partnering with fleet operators (e.g., taxi services, delivery companies) to provide dedicated charging services can ensure steady usage and revenue. Offering fleet-specific charging solutions, such as bulk pricing or subscription models, can secure long-term contracts and stable income.

08 Recommendations for implementation

This section outlines the benefits of various financing mechanisms that can be adopted to mitigate these challenges, the implementation difficulties that may arise, and the key policy and regulatory enablers required to ensure their success.

By exploring mechanisms such as risk-sharing facilities, decoupled battery and vehicle financing, operating leases, and demand aggregation, this chapter offers a detailed roadmap for addressing financial bottlenecks in the EV sector. Each financing mechansim has unique advantages that contribute to lowering costs, increasing accessibility, and fostering private and public sector investment in electric mobility.

However, implementing these mechanisms comes with its own set of challenges, ranging from regulatory hurdles to market acceptance. Furthermore, policy interventions like tax reforms, standardization of procedures, and government-backed risk mitigation measures will be essential to facilitate smoother integration of these financing models and accelerate the growth of the EV market.

8.1 Innovative Financing Mechanisms

The transition to EVs is impeded by substantial initial costs and investment uncertainties. There is a pressing need to adopt innovative financing mechanisms that can alleviate financial barriers and accelerate EV adoption.

8.1.1 Decoupling Battery and Vehicle Financing

The high upfront cost of EVs is a significant barrier to adoption, with battery packs accounting for a substantial portion of the vehicle's value. This results in higher down payments and EMIs. Decoupling the battery from the vehicle purchase offers a promising solution to this challenge, paving the way for innovative ownership models.

Separating the financing of batteries from vehicles can facilitate the adoption of battery swapping and leasing, making EVs more accessible and affordable for fleet operators. This approach not only lowers the entry barrier but also encourages the development of dedicated infrastructure for battery management. Here's how the financing framework could be structured:

Benefits of Decoupling

- **Flexible Ownership Options:** Decoupling enables new ownership models like battery leasing and pay-per-use schemes. Battery leasing also transfers the responsibility for battery maintenance and degradation to the lessor, reducing risks for the vehicle owner.
- **Risk Differentiation:** Financiers can assess and factor in risks for the vehicle and battery separately. This allows for standalone lending options for the vehicle and the battery, reducing the overall loan amount required for the vehicle itself. Consequently, this lowers the down payment and EMIs, making EV ownership more accessible.
- **Expense Management:** Operators can manage expenses related to the battery based on usage. This user-based expense model can make the financial profile of EVs more predictable and manageable for operators.
- **Battery Maintenance and Risk Transfer:** Implementing models like battery leasing can transfer the risk of battery maintenance from the operator to the lessor. This reduces the maintenance burden on operators and ensures that batteries are maintained at optimal performance levels.

Policy & Regulatory Support

Government support is crucial to facilitate the sale of vehicles and batteries as separate entities. Key areas for government intervention include:

- Rationalization of GST Rates for Lithium-Ion Batteries: Currently, lithium-ion batteries sold as part of electric vehicles attract 5% GST, but when purchased separately for use in electric vehicles, they attract 18% GST. This disparity restricts the expansion of battery swapping infrastructure. The government can consider rationalizing GST rates for Li-ion batteries used in EVs based on end use.
- Separate Registration of Vehicles Without Batteries: Many state RTOs do not register vehicles without batteries, forcing buyers to purchase vehicles with batteries at higher upfront costs. Detailing RTO procedures at the state level to streamline registration processes is required.
- Inclusion of Vehicles Without Batteries Under the FAME Subsidy Scheme: The FAME II scheme does not include provisions for vehicles sold without batteries. Although MoRTH issued an advisory to allow registration of vehicles without batteries, the lack of government support and incentives for such vehicles has limited their sales.
    - Offering financial support in the form of purchase subsidies for vehicles sold without batteries can stimulate demand.
    - Additionally, financial incentives should be provided to battery manufacturers and battery swapping station (BSS) operators to encourage their participation.

8.1.2 Encouraging Operating Leases for Fleet operators:

Operational leases from OEMs, supported by comprehensive data sharing through telematics, can monitor and enhance vehicle performance. This measure helps in reducing the financial burden on fleet operators by shifting from capital expenditure to operational expenditure. Additionally, it ensures better maintenance and longer lifespan of the vehicles due to consistent OEM involvement.

Benefits: Leasing offers several significant benefits, including financial flexibility, asset management, and operational efficiency:

- **Easy Access to Assets:** Leasing provides lessees with easy access to assets without the need for substantial upfront capital investment. This accessibility is crucial for transport companies looking to modernize their fleet while managing cash flow effectively.
- **Off-Balance Sheet Financing:** One of the primary financial advantages of leasing, particularly with operating leases, is the ability to keep the leased assets off the balance sheet. This accounting benefit can improve the lessee's leverage ratio, such as the debt-to-equity (D/E) ratio.
- **Flexibility to Upgrade:** Operating leases offer the flexibility to return or replace batteries at the end of the lease term. This option is particularly advantageous given the rapid pace of technological advancements in the sector, allowing access to the most efficient technology.

Policy and Regulatory Challenges in Leasing

- Leasing brings a set of challenges, including navigating complex tax laws, dealing with regulatory hurdles, managing asset repossession, residual value risks, and accounting challenges. Addressing these issues requires a concerted effort from all stakeholders to create a conducive environment for leasing.
  - **Tax Implications:** The tax treatment of leases depends on whether the transaction is classified as a lease or a hire purchase. Leases do not benefit uniformly from tax parity as loans do, potentially leading to discrepancies in tax liabilities. Tax reforms are needed to make leasing more tax-efficient and bring it on par with loans.
  - **GST Rules:** GST treatment does not favor leasing, especially as it differs between vehicles and batteries, complicating the leasing model. There is a need to create tax parity between leases and loans.
  - **Feasibility of Decoupling the Battery:** Decoupling batteries from EVs presents regulatory and financial challenges, especially concerning registration and insurance.
  - **Residual Value Risk:** Particularly with operating leases, OEM bears the residual value risk, making it challenging and risky to predict the future value of EVs. Establishing the residual value of EV assets and providing residual value insurance can protect against the risk of unexpected decreases in the residual value of the leased assets.
  - **Allowing sales of vehicle without batteries:** The government should play a crucial role in facilitating the sale of vehicles and batteries separately. This can be achieved by detailing Regional Transport Office (RTO) procedures at the state level to streamline registration processes.

8.1.3 Developing Mechanisms to Aggregate Demand in conjunction with concessional financing

For sectors such as e-trucks, e-buses, and e-4Ws, creating mechanisms like demand aggregation can significantly boost EV adoption. This approach can lead to substantial reductions in vehicle upfront costs through bulk purchasing and also facilitate access to low-cost funds for fleet operators.

1. **Reduced Upfront Costs:** By purchasing vehicles in bulk, buyers can negotiate significant discounts with manufacturers. This is because manufacturers can achieve economies of scale, reducing the cost per unit.
2. **Access to Low-Cost Funds:** Aggregated demand can attract better financing options. Financial institutions are more likely to offer favorable terms to large, aggregated orders due to the reduced risk and higher volume of business.
3. **Streamlined Procurement:** Aggregation simplifies the procurement process, making it easier for fleet operators to transition to EVs without dealing with multiple suppliers and contracts.

BluSmart is a prime example of how demand aggregation can facilitate EV adoption:

- Bulk Purchasing: BluSmart has built a fleet of over 6,000 electric vehicles. By purchasing these vehicles in bulk, they have been able to negotiate better prices with manufacturers, reducing the overall cost of their fleet.
- Financing: The company has leveraged its large-scale operations to secure favorable financing terms, which helps in managing the capital expenditure required for such a significant fleet. For instance, the Indian Renewable Energy Development Agency Ltd. (IREDA) sanctioned a loan of ₹267.67 crores to BluSmart Mobility for the purchase of 3,000 all-electric vehicles, leading to an expansion of its EV fleet.

A. Providing Access to Green Bonds and Climate Finance

Fleet operators with weaker financial statements often struggle to access traditional credit facilities. Offering them avenues to secure green bonds or climate finance can provide the necessary capital to scale operations.

Developing a dedicated green funding channel would help financial institutions access long-term, cheaper sources of finance. This, in turn, would allow them to offer EV loans at relatively lower interest rates, thereby improving the cost of ownership for prospective EV buyers.

Challenges for Access to Green Bonds and Climate Finance:

- High Issuance Costs: The costs associated with issuing green bonds, including certification, verification, and legal fees, can be high, particularly for smaller issuers.
- **Market Liquidity:** A limited secondary market for green bonds can affect liquidity and pricing, making it harder for issuers to sell bonds or for investors to trade them.
- **Evolving Regulations:** Changes in regulations or standards related to green bonds can create uncertainty for issuers and investors, potentially impacting market stability.
- **Lack of Standardization:** Inconsistent practices for measuring environmental impacts can undermine the credibility of green bonds and affect investor confidence.

Enablers for Access to Green Bonds and Climate Finance:

- **Institutional Framework:** Clear guidelines and regulatory frameworks for green bonds and climate finance can facilitate market growth and investor confidence.
- **Capacity Building:** Technical assistance and advisory services from development banks and financial institutions can help issuers navigate the complexities of green bond issuance and ensure compliance with standards.
- **Standardization:** Adoption of internationally recognized standards and certifications for green bonds can improve market transparency and credibility.
- **Subsidies:** Governments and development agencies can offer subsidies to reduce the cost of issuing green bonds and attract a broader range of issuers.

B. Inclusion of EVs in Priority Sector Lending

The Reserve Bank of India could categorize EVs under priority sector lending (PSL). Inclusion of EVs under PSL would make it mandatory for financial institutions to lend to the EV sector, ensuring the availability of long-term funding.

If PSL is deployed in conjunction with other modalities such as interest subvention, it would lead to a faster resolution of EV financing bottlenecks. Inclusion of EVs under PSL would also address the issue of lower participation of commercial banks, particularly for fleet operations, including e-3W/e-4W ride-hailing, e-buses, and e-trucks financing in the future.

Challenges for Implementation:

- **Credit Risk Perception:** Financial institutions often perceive the EV sector as high-risk due to concerns about battery life, technology reliability, and uncertain resale values.
- **Regulatory and Compliance Issues:** Financial institutions may face regulatory compliance challenges in adjusting their existing PSL targets and processes to accommodate EV loans.
- **Differentiation of Vehicle Segments:** The varying nature of EV segments (e.g., e-2Ws, e-3Ws, e-buses) may complicate the implementation of a uniform PSL strategy.

Enablers for Inclusion of EVs in PSL:

- **Amending PSL Guidelines:** The Reserve Bank of India (RBI) needs to amend its PSL guidelines to include EVs, specifying sub-targets for different EV segments such as e-2Ws, e-3Ws, e-buses, and e-trucks.
- **Interest Subvention and Risk Mitigation Measures:** Implement interest subvention schemes and risk-sharing facilities to reduce the perceived risk of EV financing.
- **Financial Incentives for Banks and NBFCs:** Create a reward system that includes lower capital requirements, special recognitions, or additional funding for banks that actively participate in EV financing under PSL.

8.1.4 Risk-Sharing Facility

Implementing risk-sharing mechanisms such as Risk Sharing Facility (RSF) to commercial banks can mitigate perceived financial risks. These facilities ensure that lenders have a safety net, which can spur more aggressive lending towards EV segment.

By involving multiple stakeholders, including national banks, government entities, and international development organizations, these mechanisms provide a solid foundation for investments in EV and associated infrastructure.

Benefits of Risk-Sharing Mechanisms

- Minimizes Losses for Financial Institutions: Reduces potential losses in case of a default, encouraging financial institutions to be less risk-averse.
- Prioritization of Critical Segments: Enables prioritization of more critical vehicle segments such as 2W/3Ws, and critical applications like ride-sharing and delivery.

- Enhanced Financing Availability: By mitigating lender risks, these mechanisms increase the availability of credit for potentially high-risk ventures in the EV sector.
- Lower Cost of Capital: Financial backing from risk-sharing mechanisms results in lower costs of borrowing, making large-scale investments more feasible.

Enablers

Mainstreaming Risk-Sharing Facility - Mainstreaming a Risk-Sharing Facility (RSF) can address these concerns by distributing the risks involved in financing EVs and related infrastructure projects. By implementing an RSF, commercial banks can be incentivized to extend credit with more favorable terms, such as lower interest rates and extended repayment periods, to businesses and individuals investing in electric mobility.

Standard Risk-Sharing Facility Products - A proven model for risk-sharing can be found in the Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE), which provides credit guarantees to micro and small enterprises in India. Adopting a similar standardized product for the EV sector could further encourage lending for E2Ws and E3Ws.

Such a facility would promote more inclusive lending practices, enabling a wider range of customers, including smaller operators and low-income individuals, to access credit for EVs. As more financial institutions become familiar with this standardized approach, it will increase the overall credit availability in the market, stimulating the growth of the EV ecosystem.

8.1.5 Implementing Payment Security Mechanism (PSM)-like Frameworks for Private E-Buses and E-Trucks Operators

For sectors involving larger vehicles and operations, such as e-buses and e-trucks, establishing mechanisms similar to Payment Security Mechanisms (PSM) can safeguard the interests of both private operators and financial institutions. These programs would involve sharing the financial risks associated with EV loans between the government or development banks and private lenders. This risk-sharing approach would enhance the willingness of banks to extend credit to underserved markets and risky sectors.

Establishing state-level Payment Security Mechanisms to support e-bus and e-truck operators, as well as OEMs, can protect against defaults in payments. This would encourage more robust financial backing for EV initiatives.

Challenges for Implementing Payment Security Mechanisms:

- Framework Design: Developing a PSM framework that meets the needs of all stakeholders can be complex and time-consuming.
- Integration: Integrating PSM mechanisms with existing financial systems and processes can pose challenges.
- Risk Sharing: Determining the appropriate level of risk-sharing between government, financial institutions, and private operators can be difficult.
- Implementation Costs: The initial costs of setting up and maintaining PSM frameworks can be high.

Enablers

- **Policy Framework:** Establish clear and supportive regulations for PSM frameworks, including legal backing and compliance requirements.
- **Monitoring Systems:** Develop robust systems for monitoring and managing payment performance, including default risks.
- **Policy and Regulatory Alignment:** Align PSM frameworks with existing scheme and policies to ensure compliance and support.
- **Credit Enhancement Tools:** Develop and offer credit enhancement tools, such as guarantees and insurance, to reduce perceived risks.

8.2 De-risking Measures for EV Financing

FI often perceive significant risks associated with financing EVs. These risks primarily revolve around vehicle operations, such as uncertainties in battery performance, potential technology failures, and include uncertainties about resale values Addressing these concerns is crucial for accelerating the adoption of EVs.

8.2.1 Promoting Data Telematics

Incorporating telematics systems within EVs allows for continuous monitoring and real-time data on vehicle performance and usage patterns. This technology enables more precise risk assessments and reassures lenders by providing tangible metrics on vehicle reliability and battery performance. Financial institutions (FIs) can use telematics data to understand vehicle utilization and evaluate battery health to establish residual value.

Vehicle Telematics technology can mitigate several risks for financiers in the EV sector:

- **Counterparty Risk:** Telematics can track vehicle usage and notify financiers if a borrower with a high probability of default is not driving the vehicle, allowing for proactive risk management.
- **Operational Risk:** By analyzing driving patterns, telematics can assess operational risks. Additionally, battery health data can be used to invoke warranties for vehicle repairs.

- **Residual Value:** Telematics provide detailed battery health data, offering a clear understanding of the battery's remaining life. This information helps financiers make informed decisions regarding the vehicle's residual value.

Policy and regulatory challenges

- **Data Privacy:** Tracking an EV's location can raise privacy issues, especially for retail customers. It's crucial to seek consent from borrowers and follow principles like data minimization, accuracy, use limitations, retention, and transparency. Financiers are hesitant to immobilize vehicles due to privacy concerns and limited legal guidance.

  Consent management and compliance with data privacy laws (such as India's Data Protection Bill) are necessary, and a lack of clear guidelines may deter implementation.

- **Data Interpretation:** Banks have mixed views on collecting detailed battery data, preferring an overview of battery health. OEMs are cautious about sharing detailed data due to warranty concerns and the complexity of data management.

  Financial institutions and fleet operators often need to install their own telematics devices, but these can be easily manipulated or removed, posing challenges for data collection and its accuracy.

- Associated Costs: The installation of telematics devices and the infrastructure needed for data storage and processing can be costly. These additional expenses may be a deterrent for financial institutions, particularly when dealing with smaller loans or low-margin segments like E2Ws and E3Ws.

8.2.2 Comprehensive Warranty/Guarantee by OEMs

Equipment Manufacturers (OEMs) could offer extended product warranties for EVs at an additional cost. This option would provide several benefits for both financial institutions and prospective EV buyers.

Aligning warranties and guarantees offered by OEMs with the expected lifespan of the vehicles can alleviate lender concerns about the durability and long-term performance of EVs.

Associated Benefits

- **Longer Loan Tenures:** With extended warranties, financial institutions can confidently offer loans with longer tenures. This makes Equated Monthly Installments (EMIs) more affordable for buyers, thereby accelerating the adoption of EVs.
- **Increased Confidence:** Extended warranties build more confidence among financial institutions regarding the reliability and longevity of EVs. This assurance allows them to lend at higher Loan-to-Value (LTV) ratios and lower the cost of capital.
- **Enhanced Affordability:** By spreading the cost over a longer period, extended warranties help reduce the financial burden on buyers, making EVs a more attractive option.

Extended warranties and guarantees can mitigate several risks for financiers in the EV sector

- Product Risk: Warranties effectively transfer the risk of failure due to breakdowns or product malfunctions to the Original Equipment Manufacturer (OEM). This ensures that the technology risk remains with the OEM, providing a safety net for both buyers and financial institutions.
- Residual Value Risk: Comprehensive and long-term warranties can significantly enhance the residual value of EVs. Vehicles that are still under warranty tend to fetch higher prices in the secondary market compared to those with expired warranties. This increased residual value makes EVs a more attractive investment for both buyers and lenders.

By addressing these risks, warranties play a crucial role in promoting the adoption and financing of EV, ensuring that both technology and market value risks are managed effectively.

8.2.3 Supporting the Creation of a Secondary Market for Batteries

The development of a secondary market involves two key aspects: a) establishing a market for used EVs and b) reusing batteries for mobility or stationary purposes. From a financier's perspective, this development is crucial for accurately pricing loans.

A robust secondary market offers financiers the opportunity to sell repossessed vehicles, thereby reducing potential credit losses. Enhancing battery traceability can effectively manage end-of-life disposal and support the development of a secondary market.

Challenges in creation of a Secondary Market for EV batteries

1. **Limited Data on Battery Health and Performance:** A lack of comprehensive data on battery health and performance complicates the valuation of used batteries and EVs. Accurate pricing is crucial for financiers to mitigate risks associated with loans, but limited data hinders the development of a reliable secondary market.

2. **High Costs of Battery Recycling:** The process of recycling batteries, especially lithium-ion, is cost-intensive and requires sophisticated technology and infrastructure. High operational costs can discourage investment in recycling facilities, limiting the development of a secondary market.
3. **Lack of Standardization in Battery Design and Specifications:** The absence of standardization in battery designs and specifications across different OEMs complicates recycling and reuse processes. This lack of uniformity creates logistical challenges in battery collection, refurbishment, and resale, impeding the growth of a cohesive secondary market.

Market Enablers: Supporting the Creation of a Secondary Market for Batteries

A. Developing Partnerships with Dealers:

Financial institutions often collaborate with dealers to facilitate the sale of used EVs. Dealers receive a commission, typically around 2%–3% of the outstanding loan on an electric three-wheeler. The cost of refurbishing the vehicle is included in the loan extended to the new borrower, making the process seamless and financially viable for all parties involved.

B. Prioritizing Battery Recycling:

Recycling of EV batteries is advancing, supported by government policies such as battery waste management rules. However, the implementation of these regulations varies across states and needs further attention. OEMs are legally required to ensure the responsible recycling of batteries. They assess battery health and issue extended producer responsibility certificates, ensuring legal compliance and promoting sustainable practices.

C. Establishing Battery Collection Systems:

Implementing a system where OEMs buy back used batteries can help manage end-of-life battery disposal and encourage the development of a secondary market.

- Enhancing the traceability of batteries through incentivized collection can provide detailed data on battery health,
- Financial incentives for companies that participate in battery recycling reusing can accelerate the establishment of a secondary market.

Strengthening EPR norms to mandate that manufacturers take responsibility for the entire lifecycle of their products can ensure proper disposal of batteries.

D. Implementing Extended Producer Responsibility (EPR) Programs

Strengthen EPR regulations to require OEMs to take full responsibility for the lifecycle of their batteries, including take-back, recycling, or repurposing.

- Expand current EPR norms to include stringent requirements for battery collection and recycling.
- Mandate OEMs to develop and maintain battery take-back programs, with specific targets for recycling and reuse.
- Provide fiscal incentives to OEMs that exceed EPR compliance, such as tax benefits or credits.

E. Creating Financial Incentives and Subsidies:

Offer financial incentives and subsidies to support battery recycling and secondary market development, reducing the cost burden on participating companies.

- Introduce subsidies for companies involved in battery recycling and reuse, aimed at offsetting the high costs of technology and infrastructure.
- Provide grants and funding for R&D projects focused on new battery recycling technologies, such as hydrometallurgical processes.
- Implement tax incentives for consumers purchasing refurbished batteries or vehicles with reused batteries.

F. Establishing Battery Buy-Back and Collection Programs

Develop OEM-led buy-back programs to collect used batteries, offering financial incentives to consumers for returning batteries at end-of-life.

- OEMs set up collection points at dealerships and service centers nationwide.
- Implement a buy-back pricing structure that provides consumers with discounts or cash incentives for returning used batteries.
- Collaborate with waste management companies to manage the logistics of battery collection and recycling.

Annexure 1 – List of Stakeholders Consulted

Category	Stakeholder
Development Institutes, Think Tanks and FIs	KfW
	USAID-SAREP
	Foreign, Commonwealth & Development Office- FCDO
	World Bank
	Asian Development Bank
	World Resources Institute (WRI)
	RMI
	Shakti Sustainable Energy Foundation
	OMI Foundation
	International Council on Clean Transportation (ICCT)
	Global Energy Alliance for People and Planet (GEAPP)
	SIDBI
	IREDA
	Ckers Finance
	Tata Capital
Private Stakeholders	Ola Electric (E2W OEM
	Grevol (E3W OEM)
	Mahindra Electric (E4W OEM)
	Tata Motors (E4W OEM)
	JBM Auto (E-bus OEM)
	Green Cell Mobility (E-bus Fleet Operator)
	Volvo Eicher (E-LCV)
	Alt Mobility (Fleet Operator)
	Rapida (Fleet Operator)
	Jio BP (CPOs)
	EVI technologies (CPOs)
	E-Fill Electric (CPOs)
	Sunfuel Electric (CPOs)
	Sun Mobility (Battery Swapping)
	Battery Smart (Battery Swapping)
	Log-9 Materials (Battery Manufacturer)
	SIAM (Association)
State Authorities	Kadamba Transport Corporation (State Transport Undertaking
	GEDA (Gujarat Energy Development Agency) - Goa
	West Bengal State Electricity Distribution Company Limited
	Kerala State Electricity Board

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Registered offices
Bonn and Eschborn
NDC Transport Initiative for Asia (NDC-TIA) – India component
GIZ Office
B-5/2; Safdarjung Enclave
New Delhi-110029
INDIA
T +91 11 49495353
F +91 11 49495391
I http://www.giz.de/india

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Responsible:
Mr. Amegh Gopinath
Component Leader, NDC-TIA India
Project Manager, E-Mobility

Project Team:
GIZ
Mr. Suraj Kanojia
Grant Thornton Bharat LLP
Mr. Kulbhushan Kumar
Mr. Samved Patil
Mr. Hitesh Asnani
Ms. Astha Malik
Mr. Hitesh Gupta
Mr. Akshay Kumar

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